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No. 24.

ON SPONTANEOUS COMBUSTION.

(Continued from page 104.)

On the Combustion of the Human Body, produced by the long and immoderate use of Spirituous Liquors. By PIERRE-AIME LAIR.*

IN natural as well as civil history there are facts presented to the meditation of the observer, which, though confirmed by the most convincing testimony, seem on the first view to be destitute of probability. Of this kind is that of people consumed by coming into contact with common fire, and of their bodies being reduced to ashes. How can we conceive that fire, in certain circumstances, can exercise so powerful an action on the human body as to produce this effect? One might be induced to give less faith to these instances of combustion, as they seem to be rare. I confess that at first they appeared to me worthy of very little credit, but they are presented to the public as true by men whose veracity seems unquestion-

* Tilloch, vol. 6. p. 132. From the Journal de Physique, Pluviose, year 8.

able. Bianchini, Maffei, Rolli, Le Cat, Vicq-d'Azyr, and several men distinguished by their learning, have given certain testimony of the facts. Besides, is it more surprising to experience such incineration than to void saccharine urine, or to see the bones softened to such a degree as to be reduced to the state of a jelly? The effects of this combustion are certainly not more wonderful than those of the bones softened, or of the diabetes mellitus. This morbific disposition, therefore, would be one more scourge to afflict humanity; but in physics, facts being always preferable to reasoning, I shall here collect those which appear to me to bear the impression of truth; and, lest I should alter the sense, I shall quote them such as they are given in the works from which I have extracted them.

We read in the Transactions of Copenhagen, that in 1692 a woman of the lower class, who for three years had used spirituous liquors to such excess that she would take no other nourishment, having sat down one evening on a straw chair to sleep, was consumed in the night-time, so that next morning no part of her was found but the skull and the extreme joints of the fingers; all the rest of her body, says Jacobæus, was reduced to ashes.

The following extract of the memoir of Bianchini is taken from the Annual Register for 1763:—The Countess Cornelia Bandi, of the town of Cesena, aged 62, enjoyed a good state of health. One evening, having experienced a sort of drowsiness, she retired to bed, and her maid remained with her till she fell asleep. Next morning, when the girl entered to awaken her mistress, she found nothing but the remains of her body in the most horrid condition. At the distance of four feet from the bed was a heap of ashes, in which could be distinguished the legs and arms untouched. Between the legs lay the head, the brain of which, together with half the

posterior part of the cranium, and the whole chin, had been consumed: three fingers were found in the state of a coal; the rest of the body was reduced to ashes, which, when touched, left on the fingers a fat, fœtid moisture. A small lamp which stood on the floor was covered with ashes, and contained no oil; the tallow of two candles was melted on a table, but the wicks still remained, and the feet of the candlesticks were covered with a certain moisture. The bed was not damaged; the bed-clothes and coverlid were raised up and thrown on one side, as is the case when a person gets up. The furniture and tapestry were covered with a moist kind of soot of the colour of ashes, which had penetrated into the drawers and dirtied the linen. The soot having been conveyed to a neighbouring kitchen, adhered to the walls and the utensils. A piece of bread in the cupboard was covered with it, and no dog would touch it. The infectious odour had been communicated to other apartments. The Annual Register states, that the Countess of Cesena was accustomed to bathe all her body in camphorated spirit of wine. Bianchini caused the details of this deplorable event to be published at the time when it took place, and no one contradicted them. It was attested also by Scipio Maffei, a learned cotemporary of Bianchini, who was far from being credulous; and, in the last place, this surprising fact was confirmed to the Royal Society of London by Paul Rolli. The Annual Register mentions also two other facts of the same kind which occurred in England, one at Southampton, and the other at Coventry.

An instance of the like kind is preserved in the same work * in a letter to Mr. Wilmer, surgeon:—"Mary Clues, aged 50, was much addicted to intoxication. Her

* Annual Register for 1773, p. 78.

propensity to this vice had increased after the death of her husband, which happened a year and a half before. For about a year, scarcely a day had passed in the course of which she did not drink at least half a pint of rum or aniseed-water. Her health gradually declined, and about the beginning of February she was attacked by the jaundice and confined to her bed. Though she was incapable of much action, and not in a condition to work, she still continued her old habit of drinking every day and smoking a pipe of tobacco. The bed in which she lay stood parallel to the chimney of the apartment, and at the distance from it of about three feet. On Saturday morning, the 1st of March, she fell on the floor; and her extreme weakness having prevented her from getting up, she remained in that state till some one entered and put her to bed. The following night she wished to be left alone. A woman quitted her at half after eleven, and, according to custom, shut the door and locked it. She had put on the fire two large pieces of coal, and placed a light in a candlestick on a chair at the head of her bed. At half after five in the morning a smoke was seen issuing through the window, and the door being speedily broke open, some flames which were in the room were soon extinguished. Between the bed and the chimney were found the remains of the unfortunate Clues: one leg and a thigh were still entire; but there remained nothing of the skin, the muscles, and the viscera. The bones of the cranium, the breast, the spine, and the upper extremities, were entirely calcined, and covered with a whitish efflorescence. The people were much surprised that the furniture had sustained so little injury. The side of the bed which was next to the chimney had suffered the most; the wood of it was slightly burnt; but the feather-bed, the clothes, and covering, were safe. I entered the apartment about two hours after it had been open-

ed, and observed that the walls and every thing in it were blackened; that it was filled with a very disagreeable vapour; but that nothing except the body exhibited any strong traces of fire."

This instance has great similarity to that related by Vicq-d'Azyr in the *Encyclopédie Methodique*, under the head, Pathologic Anatomy of Man. A woman, about fifty years of age, who indulged to excess in spirituous liquors, and got drunk every day before she went to bed, was found entirely burnt, and reduced to ashes. Some of the osseous parts only were left, but the furniture of the apartment had suffered very little damage. Vicq-d'Azyr, instead of disbelieving this phenomenon, adds, that there have been other instances of the like kind.

We find also a circumstance of this kind in a work entitled, *Acta Medica et philosophica Hafniensia;* and in the work of Henry Bohanser, entitled, *Le nouveau phosphore enflammé.* A woman at Paris, who had been accustomed, for three years, to drink spirit of wine to such a degree that she used no other liquor, was one day found entirely reduced to ashes, except the skull and extremities of the fingers.

The Transactions of the Royal Society of London present also an instance of human combustion no less extraordinary: It was mentioned at the time it happened in all the journals; it was then attested by a great number of eye-witnesses, and became the subject of many learned discussions. Three accounts of this event, by different authors, all nearly coincide. The fact is related as follows:—"Grace Pitt, the wife of a fishmonger of the parish of St. Clement, Ipswich, aged about sixty, had contracted a habit, which she continued for several years, of coming down every night from her bedroom, half dressed, to smoke a pipe. On the night of the 9th of April, 1744, she got up from bed as usual.

Her daughter, who slept with her, did not perceive she was absent till next morning when she awoke, soon after which she put on her clothes, and going down to the kitchen, found her mother stretched out on the right side, with her head near the grate; the body extended on the hearth, with the legs on the floor, which was of deal, having the appearance of a log of wood, consumed by a fire without apparent flame. On beholding this spectacle, the girl ran in great haste and poured over her mother's body some water contained in two large vessels in order to extinguish the fire; while the fœtid odour and smoke which exhaled from the body almost suffocated some of the neighbours who had hastened to the girl's assistance. The trunk was in some measure incinerated, and resembled a heap of coals covered with white ashes. The head, the arms, the legs, and the thighs, had also participated in the burning. This woman, it is said, had drunk a large quantity of spirituous liquor in consequence of being overjoyed to hear that one of her daughters had returned from Gibraltar. There was no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick, which was close to her. Besides, there were found near the consumed body the clothes of a child and a paper screen, which had sustained no injury by the fire. The dress of this woman consisted of a cotton gown.

Le Cat, in a memoir on spontaneous burning, mentions several other instances of combustion of the human body. "Having," says he, "spent several months at Rheims in the years 1724 and 1725, I lodged at the house of Sieur Millet, whose wife got intoxicated every day. The domestic economy of the family was managed by a pretty young girl, which I must not omit to remark, in order that all the circumstances which accompanied the fact I am about to relate, may be better understood. This

woman was found consumed on the 20th of February, 1725, at the distance of a foot and a half from the hearth in her kitchen. A part of the head only, with a portion of the lower extremities and a few of the vertebræ, had escaped combustion. A foot and a half of the flooring under the body had been consumed, but a kneading-trough and a powdering-tub, which were very near the body, had sustained no injury. M. Chretien, a surgeon, examined the remains of the body with every juridical formality. Jean Millet, the husband, being interrogated by the judges who instituted an inquiry into the affair, declared, that about eight in the evening on the 19th of February he had retired to rest with his wife, who, not being able to sleep, had gone into the kitchen, where he thought she was warming herself; that, having fallen asleep, he was wakened about two o'clock by an infectious odour, and that, having run to the kitchen, he found the remains of his wife in the state described in the report of the physicians and surgeons. The judges having no suspicion of the real cause of this event, prosecuted the affair with the utmost diligence. It was very unfortunate for Millet that he had a handsome servant-maid, for neither his probity nor innocence was able to save him from the suspicion of having got rid of his wife by a concerted plot, and of having arranged the rest of the circumstance in such a manner as to give it the appearance of an accident. He experienced, therefore, the whole severity of the law; and though, by an appeal to a superior and very enlightened court, which discovered the cause of the combustion, he came off victorious, he suffered so much from uneasiness of mind, that he was obliged to pass the remainder of his melancholy days in an hospital."

Le Cat relates another instance, which has a most perfect resemblance to the preceding:—"M. Boinneau, curé

of Plerguer, near Dol," says he, "wrote to me the following letter, dated February 22, 1749: Allow me to communicate to you a fact which took place here about a fortnight ago. Madame de Boiseon, 80 years of age, exceedingly meagre, who had drunk nothing but spirits for several years, was sitting in her elbow-chair before the fire while her waiting-maid went out of the room for a few moments. On her return, seeing her mistress on fire, she immediately gave an alarm, and some people having come to her assistance, one of them endeavoured to extinguish the flames with his hand, but they adhered to it as if it had been dipped in brandy or oil on fire. Water was brought and thrown on the lady in abundance, yet the fire appeared more violent, and was not extinguished till the whole flesh had been consumed. Her skeleton, exceedingly black, remained entire in the chair, which was only a little scorched; one leg only, and the two hands, detached themselves from the rest of the bones. It is not known whether her clothes had caught fire by approaching the grate. The lady was in the same place in which she sat every day; there was no extraorninary fire, and she had not fallen. What makes me suspect that the use of spirits might have produced this effect is, that I have been assured, that at the gate of Dinan an accident of the like kind happened to another woman under similar circumstances."

To these instances, which I have multiplied to strengthen the evidence, I shall add two other facts of the same kind, published in the *Journal de Medicine.** The first took place at Aix, in Provence, and is thus related by Muraire, a surgeon:—"In the month of February, 1779, Mary Jauffret, widow of Nicholas Gravier, shoemaker, of a small size, exceedingly corpulent,

* Vol. 59. p. 440.

and addicted to drinking, having been burnt in her apartment, M. Rocas, my colleague, who was commissioned to make a report respecting the remains of her body, found only a mass of ashes, and a few bones, calcined in such a manner that on the least pressure they were reduced to dust. The bones of the cranium, one hand, and a foot, had in part escaped the action of the fire. Near these remains stood a table untouched, and under the table a small wooden stove, the grating of which, having been long burnt, afforded an aperture, through which, it is probable, the fire that occasioned the melancholy accident had been communicated: one chair, which stood too near the flames, had the seat and fore-feet burnt. In other respects, there was no appearance of fire either in the chimney or the apartment; so that, except the fore-part of the chair, it appears to me that no other combustible matter contributed to this speedy incineration, which was effected in the space of seven or eight hours."

The other instance, mentioned in the *Journal de Medicine*,* took place at Caen, and is thus related by Merille, a surgeon of that city, still alive:—"Being requested, on the 3d of June, 1782, by the king's officers, to draw up a report of the state in which I found Mademoiselle Thuars, who was said to have been burnt, I made the following observations:—The body lay with the crown of the head resting against one of the andirons, at the distance of eighteen inches from the fire; the remainder of the body was placed obliquely before the chimney, the whole being nothing but a mass of ashes. Even the most solid bones had lost their form and consistence; none of them could be distinguished except the coronal, the two parietal bones, the two lumbar ver-

* Vol. 59. p. 140.

tebræ, a portion of the tibia, and a part of the omoplate; and these, even, were so calcined, that they became dust by the least pressure. The right foot was found entire, and scorched at its upper junction; the left was more burnt. The day had been cold, but there was nothing in the grate except two or three bits of wood, about an inch in diameter, burnt in the middle. None of the furniture in the apartment was damaged. The chair on which Mademoiselle Thuars had been sitting, was found at the distance of a foot from her, and absolutely untouched. I must here observe, that this lady was exceedingly corpulent; that she was above sixty years of age, and much addicted to spirituous liquors; that the day even of her death she had drunk three bottles of wine and about a bottle of brandy; and that the consumption of the body had taken place in less than seven hours, though, according to appearance, nothing around the body was burnt but the clothes."

The town of Caen affords several other instances of the same kind. I have been told by many people, and particularly a physician of Argentan, named Bouffet, author of an Essay on Intermittent Fevers, that a woman of the lower class, who lived at *Place Villars*, and who was known to be much addicted to strong liquor, had been found in her house burnt. The extremities of her body only were spared, but the furniture was very little damaged.

A like unfortunate accident happened also at Caen to another old woman addicted to drinking. I was assured by those who told me the fact, that the flames which proceeded from the body could not be extinguished by water; but I think it needless to relate the particulars of this and of another similar event which took place in the same town, because, as they were not attested by a *pro-*

ces-verbal, and not having been communicated by professional men, they do not inspire the same confidence.

This collection of instances is supported, therefore, by all those authentic proofs which can be required to form human testimony; for, while we admit the prudent doubt of Descartes, we ought to reject the universal doubt of the Pyrrhonists. The multiplicity and uniformity even of these facts, which occurred in different places, and were attested by so many enlightened men, carry with them conviction; they have such a relation to each other, that we are inclined to ascribe them to the same cause.

1. The persons who experienced the effects of this combustion had for a long time made an immoderate use of spirituous liquors.

2. The combustion took place only in women.

3. These women were far advanced in life.

4. Their bodies did not take fire spontaneously, but were burnt by accident.

5. The extremities, such as the feet and the hands, were generally spared by the fire.

6. Water sometimes, instead of extinguishing the flames which proceeded from the parts on fire, gave them more activity.

7. The fire did very little damage, and often even spared the combustible objects which were in contact with the human body at the moment when it was burning.

8. The combustion of these bodies left as a residuum fat fœtid ashes, with an unctuous, stinking, and very penetrating soot.

Let us now enter into an examination of these eight general observations.

The first idea which occurs on reading the numerous instances of human combustion above related is, that those who fell victims to those fatal accidents were al-

most all addicted to spirituous liquors. The woman mentioned in the Transactions of Copenhagen had for three years made such an immoderate use of them, that she would take no other nourishment. Mary Clues, for a year before the accident happened, had scarcely been a single day without drinking half a pint of rum or of aniseed-water. The wife of Millet had been continually intoxicated; Madame de Boiseon for several years had drunk nothing but spirits; Mary Jauffret was much addicted to drinking; and Mademoiselle Thuars, and the other women of Caen, were equally fond of strong liquors.

Such excess, in regard to the use of spirituous liquors, must have had a powerful action on the bodies of the persons to whom I allude. All their fluids and solids must have experienced its fatal influence; for the property of the absorbing vessels, which is so active in the human body, seems on this occasion to have acted a distinguished part. It has been observed that the urine of great drinkers is generally aqueous and limpid. It appears, that in drunkards who make an immoderate use of spirituous liquors, the aqueous part of their drink is discharged by the urinary passage, while the alcoholic, almost like the volatile part of aromatic substances, not being subjected to an entire decomposition, is absorbed into every part of their bodies.

I shall now proceed to the second general observation, that the combustion took place only in women.

I will not pretend to assert that men are not liable to combustion in the same manner, but I have never yet been able to find one well certified instance of such an event; and as we cannot proceed with any certainty but on the authority of facts, I think this singularity so surprising as to give rise to a few reflections. Perhaps when the cause is examined, it will appear perfectly na-

tural. The female body is in general more delicate than that of the other sex. The system of their solids is more relaxed; their fibres are more fragile and of a weaker structure, and therefore their texture more easily hurt. Their mode of life also contributes to increase the weakness of their organization. Women, abandoned in general to a sedentary life, charged with the care of the internal domestic economy, and often shut up in close apartments, where they are condemned to spend whole days without taking any exercise, are more subject than men to become corpulent. The texture of the soft parts in female bodies being more spongy, absorption ought to be freer; and as their whole bodies imbibe spirituous liquors with more ease, they ought to experience more readily the impression of fire. Hence that combustion, the melancholy instances of which seem to be furnished by women alone; and it is owing merely to the want of a certain concurrence of circumstances and of physical causes, that these events, though less rare than is supposed, do not become more common.

The second general observation serves to explain the third; I mean, that the combustion took place only in women far advanced in life. The Countess of Cesena was sixty-two years of age; Mary Clues, fifty-two; Grace Pitt, sixty; Madame de Boiseon, eighty; and Mademoiselle Thuars more than sixty. These examples prove that combustion is more frequent among old women. Young persons, distracted by other passions, are not much addicted to drinking; but when love, departing along with youth, leaves a vacuum in the mind, if its place be not supplied by ambition or interest, a taste for gaming, or religious fervor, it generally falls a prey to intoxication. This passion still increases as the others diminish, especially in women, who can indulge it without restraint. Wilmer, therefore, observes, "that

the propensity of Mary Clues to this vice had always increased after the death of her husband, which happened about a year before:" almost all the other women of whom I have spoken, being equally unconfined in regard to their actions, could gratify their attachment to spirituous liquors without opposition.

It may have been observed that the obesity of women, as they advance in life, renders them more sedentary; and if, as has been remarked by Baumes,* a sedentary life overcharges the body with hydrogen, this effect must be still more sensible among old women. Dancing and walking, which form salutary recreation for young persons, are at a certain age interdicted as much by nature as by prejudice. It needs therefore excite no astonishment that old women, who are in general more corpulent and more addicted to drinking, and who are often motionless like inanimate masses, during the moment of intoxication, should experience the effects of combustion.

Perhaps we have no occasion to go very far to search for the cause of these combustions. The fire of the wooden stove, the chimney, or of the candle, might have been communicated to the clothes, and might have in this manner burnt the persons above mentioned, on account of the peculiar disposition of their bodies. Maffei observes, that the Countess of Cesena was accustomed to bathe her whole body with spirit of wine. The vicinity of the candle and lamp, which were found near the remains of her body, occasioned, without doubt, the combustion. This accident reminds us of that which happened to Charles II. king of Navarre. This prince, being addicted to drunkenness and excesses of every kind, had caused himself to be wrapped up in cloths dipped in spirits, in order to revive the natural heat of his body,

* Essai du Système Chemique de la Science de l'Homme.

which had been weakened by debauchery; but the cloths caught fire while his attendants were fastening them, and he perished a victim to his imprudence.

Besides accidental combustion, it remains for us to examine whether spontaneous combustion of the human body can take place, as asserted by Le Cat. Spontaneous combustion is the burning of the human body without the contact of any substance in a state of ignition. Nature, indeed, affords several instances of spontaneous combustion in the mineral and vegetable kingdoms. The decomposition of pyrites, and the subterranean processes which are carried on in volcanoes, afford proofs of it. Coal-mines may readily take fire spontaneously; and this has been found to be the case with heaps of coals deposited in close places. It is by a fermentation of this kind that dunghills sometimes become hot, and take fire. This may serve also to explain why trusses of hay, carried home during moist weather, and piled up on each other, sometimes take fire. But, can spontaneous combustion take place in the human body? If some authors are to be credited,* very violent combustion may be produced in our bodies by nature and by artificial processes. Sturmius† says, that in the northern countries flames often burst from the stomach of persons in a state of intoxication. Three noblemen of Courland having laid a bet which of them could drink most spirits, two of them died in consequence of suffocation by the flames which issued with great violence from their stomachs. We are told by Thomas Bartholin,‡ on the authority of Vorstius, that a soldier, who had drunk two glasses of spirits, died after an eruption of flames from his mouth. In his third century Bertholin mentions another accident of the same kind after a drinking-match of strong liquor.

* German Ephemerides, Observ. 77. † Ibid. Tenth year, p. 55.
‡ First century.

It now remains to decide, from these instances, respecting the accidental or spontaneous causes which produce combustion. Nature, by assuming a thousand different forms, seems at first as if desirous to elude our observation; but, on mature, reflection, if it be found easy to prove accidental combustion, spontaneous combustion appears altogether improbable; for, even admitting the instances of people suffocated by flames which issued from their mouths, this is still far from the combustion of the whole body. There is a great difference between this semi-combustion and spontaneous combustion so complete as to reduce the body to ashes, as in the cases above mentioned. As the human body has never been seen to experience total combustion, these assertions seem rather the production of a fervid imagination than of real observation; and it too often happens that Nature in her mode of action does not adopt our manner of seeing.

I shall not extend further these observations on the combustion of the human body, as I flatter myself that after this examination every person must be struck with the relation which exists between the cause of this phænomenon and the effects that ensue. A system embellished with imaginary charms is often seducing, but it never presents a perfect whole. We have seen facts justify reasoning, and reasoning serve afterwards to explain facts. The combustion of the human body, which on the first view appears to have in it something of the marvellous, when explained, exhibits nothing but the utmost simplicity: so true it is, that the wonderful is often produced by effects which, as they rarely strike our eyes, permit our minds so much the less to discover their real cause.

Some people, however, may ascribe to the wickedness of mankind what we ascribe to accident. It may be said, that assassins, after putting to death their unfortunate

victims, rubbed over their bodies with combustible substances, by which they were consumed. But even if such an idea should ever be conceived, it would be impossible to carry it into execution. Formerly, when criminals were condemned to the flames, what a quantity of combustible substances were necessary to burn their bodies! A baker's boy, named Renaud, being condemned to be burnt a few years ago at Caen, two large cart-loads of faggots were required to consume the body, and at the end of more than ten hours some remains of the bones were still to be seen. What proves that the combustion in the before-mentioned instances was not artificial is, that people often arrived at the moment when it had taken place, and that the body was found in its natural state. People entered the house of Madame Boiseon at the time when her body was on fire, and all the neighbours saw it. Besides, the people of whom I have spoken were almost all of the lowest class, and not much calculated to give rise to the commission of such a crime. The woman mentioned in the Transactions of Copenhagen was of the poorest condition; Grace Pitt was the wife of a fishmonger; Mary Jauffret that of a shoemaker; and two other women, who resided at Caen, belonged to the lowest order of society. It is incontestible, then, that in the instances I have adduced the combustion was always accidental and never intentional.

It may be seen that a knowledge of the causes of this phenomenon is no less interesting to criminal justice than to natural history, for unjust suspicions may sometimes fall on an innocent man. Who will not shudder on recollecting the case of the unfortunate inhabitant of Rheims, who, after having lost his wife by the effect of combustion, was in danger of perishing himself on the scaffold, condemned unjustly by an ignorant tribunal!

I shall consider myself happy if this picture of the

fatal effects of intoxication makes an impression on those addicted to this vice, and particularly on women, who most frequently become the victims of it. Perhaps the frightful details of so horrid an evil as that of combustion will reclaim drunkards from this horrid practice. Plutarch relates, that at Sparta children were deterred from drunkenness by exhibiting to them the spectacle of intoxicated slaves, who, by their hideous contortions, filled the minds of these young spectators with so much contempt, that they never afterwards got drunk. This state of drunkenness, however, was only transitory. How much more horrid it appears in those unfortunate victims consumed by the flames and reduced to ashes! May men never forget that the vine sometimes produces very bitter fruit—disease, pain, repentance, and death!

(To be continued.)

No. 25.

A Treatise on the Cultivation of the Vine, and the Method of Making Wines. *By* C. CHAPTAL.

(Continued from page 138.)

EXPOSURE.—The same climate, the same cultivation, and the same soil, often furnish wines of very different qualities. We may daily see some mountain, the summit of which is entirely covered with vines, present in its different aspects astonishing varieties in the wines they produce. Were we to judge of places by comparing the nature of their productions, we should be often induced to believe that every climate and every kind of soil has concurred to furnish productions which, in fact, are only the natural fruit of the same lands differently exposed.

This difference in the products, arising from exposure alone, may be observed in all the effects that depend on vegetation. Wood cut down in a part of a forest looking towards the north, is far less combustible than that which grows towards the south: odoriferous and savoury plants lose their perfume and savour when reared in fat soil exposed to the north. Pliny had observed that the wood on the south side of the Appenines was of a better quality than that which grew in any other exposure: and every body knows what the effects of exposure are in regard to pulse and fruits.

These phænomena, which are perceptible in regard to all vegetable productions, are particularly so in regard to grapes. A vine turned towards the south produces fruit very different from those which look towards the north. The surface of the soil planted with vines, by being more or less inclined, though with the same exposure, presents also modifications without end. The summit, the middle, and the bottom of a hill give productions very different. The summit, being uncovered, continually receives the impressions of every change and of every movement that takes place in the atmosphere; the winds harass the vine in every direction; a more constant and more direct impression is made on it by fogs; the temperature is more variable and cold. All these circumstances united, cause the grapes there to be less abundant; they come with more difficulty, and in a less complete manner, to maturity; and the wine arising from them is of an inferior quality to that furnished by the sides of the hill, which by their position are sheltered from the greater part of the fatal effects of these causes. The bottom of the hill, on the other hand, presents very great inconveniences: the constant coolness of the soil, no doubt, gives the vines great vigour; but the grapes are never so saccharine, nor

have such an agreeable flavour as those which grow towards the middle region: the air there being constantly charged with moisture, and the soil always impregnated with water, enlarge the grapes, and force the vegetation, to the detriment of the quality.

The most favourable exposuse for the vine is between the east and the south.

Opportunus ager tepidos qui vergit ad æstus.

Small hills rising above a plain intersected by a stream of pure water, give the best wine; but these hills ought not to lie too close to each other:

——————————apertos
Bacchus amat colles——————

A northern exposure has at all times been considered as the most fatal: the cold damp winds do not favour the ripening of the grapes; they always remain harsh, sour, and destitute of saccharine principle; and the wine must participate in these bad qualities.

A south exposure is also not very favourable: the earth, dried by the heat in the day-time, presents, towards evening, to the oblique rays of the sun (become almost parallel to the horizon) but an arid soil destitute of all moisture; the sun, which by its position penetrates then under the vine, and darts its rays upon the grapes, which have no longer any shelter, dries and heats them, ripens them prematurely, and checks the vegetation before the period of fulness and maturity has arrived.

Nothing is more proper to enable us to judge of the effects of exposure than to observe what takes place in a vineyard, the ground of which is unequal, and interspersed here and there with a few trees: there all exposures seem to be united in one spot; all the effects thence

depending present themselves to the observer. The stems of vine sheltered by the trees throw out long slender twigs, which bear little fruit, and lead to slow and imperfect maturity. The highest portion of the vine is in general the barest; vegetation there is less vigorous; but the grapes are of a better quality than in low situations. The best grapes are always found in those places most exposed to the south.*

4. *Seasons.*—It is well known that the nature of the vine varies according to the character of the season; and its effects may be naturally deduced from the principles we have established in speaking of the influence of climate, soil, and exposure; since we have shown how to ascertain what effects moisture, cold, and heat, may have on the formation and quality of the grapes. A cold and rainy season, indeed, in a country naturally hot and dry, will produce on the grapes the same effect as a northern climate: this state of the temperature, by bringing together these climates, assimilates and identifies all the productions of them.

The vine is fond of warmth, and the grapes never come to perfection but in dry soil exposed to the rays of an ardent sun. When a rainy year keeps the soil in a state of continual humidity, and maintains a moist, cold temperature in the atmosphere, the grapes will acquire neither flavour nor saccharine principles; and the wine they produce will be necessarily abundant, weak, and insipid.

* The general principles, in regard to the influence of exposure, admit of many exceptions: the famous vineyards of Epernai and Versenai, in the mountain of Rheims, are fully exposed to the north, in a latitude so northern for vines, that it is in those places where the region of the vine suddenly terminates under that meridian.

The vineyards of Nuits and Beaune, as well as the best of Beaugenci and Blois, lie towards the east; those of Loire and Cher lie indiscriminately towards the north and south; the excellent hills of Seaumur face the north; and the best vines of Angers are produced from vines which grow in all exposures,—*Observations de Creuzé-Latouche lues à la Societé d'Agriculture de Paris.*

These kinds of wine can be preserved with difficulty; the small quantity of alcohol which they contain cannot secure them from decomposition, and the large proportion of extractive matter in them determines movements which continually tend to change their nature. These wines turn oily, and sometimes *sour;* but the small quantity of alcohol they contain prevents them from forming good vinegar: they all contain a great deal of malic acid, as we shall prove hereafter, and it is this acid which gives them their peculiar taste; an acidity which is not acetous, and which forms a more prevailing character in wines in proportion as they are less spirituous.

The influence of the seasons on the vine is well known in all countries where vineyards are planted, that, long before the vintage, the nature of the wine may be predicted. In general, when the season is cold, the wine is harsh, and has a bad taste; when rainy, it is abundant, weak, and not at all spirituous: it is therefore destined for distillation, at least in the south of France, because it would be disagreeable to drink, and difficult to be preserved.

The rains which come on when the vintage approaches are always the most dangerous: the grapes then have neither time nor sufficient strength to mature the juice; and they become filled with a very liquid fluid, which holds in solution too small a quantity of sugar for the produce of the decomposition to be either strong or spirituous.

The rains which fall when the grapes are increasing in size, are exceedingly favourable: they assist the organization of the vegetable, furnish it with its principal nutrition, and, if continued heat facilitate the maturation, the quality of the grapes must be perfect.

Winds are always prejudicial to the vine: they dry up the branches, the grapes, and the soil; and they produce, particularly in strong soil, a hard compact crust, which

impedes the free passage of the air and water, and by these means maintains around the roots a putrid moisture which tends to corrupt them. The farmers, therefore, carefully avoid planting vines in situations exposed to wind: they prefer calm situations, well sheltered, where the plants may be exposed only to the benign influence of the luminary towards which they are placed.

Fogs are also exceedingly dangerous to the vine: they are destructive to the blossoms, and do essential hurt to the grapes. Besides the putrid miasmata, which they too often deposit on the productions of the fields, they are always attended with the inconvenience of moistening the surfaces, and of forming on them a stratum of water, more subject to evaporation, as the interior of the plant and the earth are not moistened in the same proportion; so that the rays of the sun, falling upon this light stratum of moisture, cause it to evaporate in an instant; and the sensation of coolness, determined by the act of evaporation, is succeeded by a heat the more prejudicial as the transition is abrupt. It very often happens that the clouds suspended in the atmosphere, by concentrating the rays of the sun, direct them towards parts of the vines, by which means they are burnt. In the scorching climates of the south, it is sometimes observed that the natural heat of the soil, strengthened by the reverberation from certain rocks, or whitish kinds of soil, dries up the grapes exposed to them.

Though heat be necessary for ripening the grapes, giving them a saccharine taste and a good flavour, it would be erroneous to believe that its action alone can produce every effect required. It can be considered only as a mean necessary for maturation, which supposes that the earth is sufficiently furnished with the juices that ought to supply the materials. Heat is necessary; but this heat must not be exercised on dried earth, for in that case it

it burns rather than vivifies. The good state of vines, and the good quality of the grapes, depend then on a just proportion—a perfect equilibrium between the water, which furnishes the aliment to the plant, and the heat, that can alone facilitate its maturation.

5. *Culture.*—The vine grows naturally in Florida, America, and almost every part of Peru. In the south of France, even almost all the hedges abound with wild vines; but the grapes they bear are always smaller, and, though they come to maturity, they never acquire the exquisite taste of the grapes that are cultivated. The vine then is the work of nature, but art changes its products by bringing the culture of it to perfection. The difference which exists at present between the cultivated vine and that which grows wild, is the same as that established by art between the vegetables of our gardens and those of the same kind which grow accidentally in the fields.*

The culture of the vine, however, has its rules as well as its boundaries. The soil where it grows requires great care; it must be often dug up; but it refuses the manure necessary for other plantations. It must here be remarked, that all those causes which powerfully concur to give activity to the vegetation of the vine, alter the quality of the grapes; and here, as in other delicate cases, the culture ought to be directed in such a manner that the plant may receive only poor nourishment if grapes of a good quality are required. The celebrated Olivier de Serres says on this subject, that, "by a public decree, dunging is forbidden at Gaillac for fear of lessening the reputation of the white wines, with which the

* These observations are well worthy of attention; since they will naturally lead to a due investigation of the merits of our native vines; which have one great advantage over those of foreign origin, viz. their being uninjured by our coldest winters. Ed.

people of that district supply their neighbours of Toulouse, Montauban, Castres, and other places, and of thus depriving them of the great profit thence arising, which forms the best part of their revenue."

There are some individuals, however, who, in order to have a more abundant crop, dung their vines; but they thus sacrifice the quality to quantity.

The dung most favourable to the vine is that of pigeons or poultry; dung too fœtid or too putrid is carefully rejected, as it has been proved by observation that the wine often contracts from it a very disagreeable taste.

In the isles of Rhé and Oleron the vines are dunged with sea-weed *(fucus)*; but the wine thence acquires a bad quality, and retains the peculiar odour of that plant. Chasseron has observed, that the same plant decomposed into mould manures the vine with advantage, and increases the quantity of the wine without hurting the quality. Experience has also taught him that the ashes of sea-weed form excellent manure for the vine. This able agriculturist is of opinion that vegetable manure is not attended with the same inconveniences as animal manure; but he thinks, and with justice, that the former cannot be used with advantage except when employed in the state of mould.

The method of cultivating vines on poles or props ought to be commanded by the climate. This method belongs to cold countries, where the vine has need of the whole heat of the sun, naturally weak. By raising them, therefore, on poles placed perpendicular to the ground, the earth, being uncovered, receives all the activity of the rays, and the whole surface of the plant is completely exposed to their action. Another advantage of cultivating on props is, that it allows the vines to be placed nearer to each other, and that the produce is multiplied on equal surfaces. But in warmer climates the

earth requires to be sheltered from the excessive heat of the sun; the grapes themselves have need of being protected from its scorching rays, and to accomplish this view the vines are suffered to creep on the ground; they then every where form a covering sufficiently thick and close to defend the earth, and a great part of the grapes, from the direct action of the sun. But when the increase of the grapes has attained to its maximum, and nothing is necessary but to bring them to maturity, the cultivators collect in bundles the different branches of the vine, uncover the grapes, and by these means facilitate the maturation. In this case they really produce the same effect as is produced by propping; but recourse is had to this method only when the grapes are too abundant, or when the vines grow in soil too fat or humid. In some countries the vines are stripped of their leaves, which produces nearly the same effect; in others, the pedicle of the grapes is twisted to determine the maturity by checking the vegetation. The ancients, according to Pliny, prepared their sweet wines in this manner: *Ut dulcia præterea fierent, asservabant uvas diutiùs in vite, pediculo intorto.*

The method of pruning the vines has also a great influence on the nature of the wine. The greater the number of branches left to one vine, the more abundant the grapes, but the worse is the quality of the wine.

The art of cultivating the vine, and the method of planting it, have a powerful influence on the quality and quantity of the wine. To show the effect which cultivation has on the vine, it will be sufficient to observe what takes place in regard to vines left to themselves; it will be found that the soil, soon covered with foreign plants, acquires firmness, and is afterwards but imperfectly accessible to the air and to water. The vine, being no longer pruned, sends forth weak shoots, and produces grapes

which decrease in size year after year, and which scarcely ever come to maturity. It is no longer that vigorous plant the annual vegetation of which covered the soil to a great distance. The grapes are no more that well-nourished fruit which afforded sound and saccharine aliment; the vine becomes stunted, and its fruit, of a bad and weak quality, attests the languid and ruinous state of the soil. By what are these changes produced? By the want of cultivation.

We may therefore consider the good state of the soil as the work of nature: all the art consists in stirring it, turning it up several times, and at favourable periods. By these means it is freed from all noxious plants, and it is better prepared for receiving water, and for transmitting it with more ease to the plant; the air also can penetrate to it with more ease, and thus all those conditions necessary for proper vegetation are united. But when, on account of some particular speculations, it is necessary to obtain wine in greater abundance, and when the quality may be sacrificed to this consideration, the vines in that case may be dunged, more shoots may be allowed to the stems, and all the causes which can multiply the grapes may be united.

II. *Of the Time most favourable for the Vintage, and the Processes employed during that Period.*

Olivier de Serres observes, with great justice, that if the management of the vine requires great skill and intelligence, it is at the period of the vintage that these things are necessary, to obtain in perfection and abundance the fruits which Providence thence distributes to us. Every body allows that the moment most favourable for the vintage is that when the grapes come to maturity; but this maturity can be known only by the union of the following signs:

1st, The green stalk of the grapes turns brown.

2d, The grapes become pendulous.

3d, The stones of the grapes lose their hardness; the pellicle becomes thin and transparent, as is observed by Olivier de Serres.

4th, The clusters and grapes can be easily detached from the twigs.

5th, The juice of the grapes is savoury, sweet, thick, and viscid.

6th, The stones of the grapes are free from any glutinous substance, according to the observation of Olivier de Serres.

The fall of the leaves announces rather the return of winter than the maturity of the grapes; this sign, therefore, is considered as very uncertain, as well as putridity, which a thousand causes may occasion, none of them sufficient to enable us to deduce from them a proof of maturity. When the frost, however, makes the leaves to fall, the vintage ought not to be longer deferred, because the grapes are then susceptible of no further maturity. Their remaining on the vine could tend only to promote putrefaction.

"In 1769, the grapes, still green," says Rozier, "were surprised by the frost on the 7th, 8th, and 9th of October. They gained nothing more by remaining on the vines till the end of the month; and the wine was acid and of a bad colour.

There are some qualities in wine which cannot be obtained but by suffering the grapes to dry on the twigs. Thus, at Rivesaltes, and in the islands of Candia and Cyprus, the grapes are suffered to remain exposed to the winds before they are cut. The grapes which furnish tokay are dried; and the same process is employed for some of the sweet wines of Italy. The wines of Arbois, and of Chateau-Chalons, in Franche-Comté, are

produced from grapes which are not cut till towards the end of December; at Condrieu, where the white wine is celebrated, the grapes are not cut till near the middle of November. In Tourraine, and other places, a kind of wine called *vin de paille* is made, by collecting the grapes during dry weather, and when the sun is in full force; they are spread out, so as not to touch each other, on hurdles, which are exposed to the sun, and then shut up when he is set; the grapes which rot are carefully removed, and when the whole are well dried, the juice is expressed and made to ferment.

Olivier de Serres says, it has been proved by experience, that the best period of the moon for collecting grapes in order that they may keep, is her decrease rather than her increase. He, however, allows, that when the grapes are ripe it is better to consult the weather than the moon; and in this we perfectly agree with him.

But there are some climates where the grapes never come to maturity: such are almost all the northern parts of France; and in that case the grapes must be collected green, that they may not be exposed to rot on the twigs. A moist and rainy autumn must increase the bad quality of the juice. All the vineyards in the neighbourhood of Paris are in this situation; the vintage there is, of course, earlier than in the south, where the grapes never cease to ripen, though the heat of the sun continually decreases.

When the necessity of commencing the vintage has been ascertained, a great many precautions must be taken before it is begun. In general, the vintagers ought not to venture to labour but when the soil and the grapes are dry, and until the weather appears so settled as to give reason to believe that their occupations will not be interrupted. Olivier de Serres recommends, not to collect the grapes till the sun has dispersed the dew deposited

on them by the coolness of the nights: this precept, though generally true, cannot be universally applied; for in Champagne the vintagers collect the grapes before sunrise, and suspend their labours towards nine in the morning, unless the fogs occasion humidity throughout the whole day: it is only by this care that they obtain white and brisk wines. It is well known in Champagne, that twenty-five casks of wine are obtained instead of twenty-four, when the vintagers labour during the continuance of the dew; and twenty-six during the fog. This process is every where useful when wines exceedingly white and brisk are required. Except in the above cases the grapes ought not to be cut until the sun has dispersed all the moisture from their surface.

But some precautions are necessary to ascertain the period most proper for the vintage, and some must be observed in regard to the mode of operation. An intelligent agriculturist will not commit the care of cutting the grapes to inexpert mercenaries: as this part of the labour is not the least important, we shall here give a few observations on it.

1st, A sufficient number of vintagers ought to be engaged that the vat may be filled in one day: this is the only method of obtaining an equal fermentation.

2d, Women on the spot should be preferred; and none ought to be employed but those who have become expert in this kind of labour.

3d, The labourers ought to be under the superintendance of a strict and intelligent overseer.

4th, They ought to be prohibited from eating the grapes, both to prevent crusts of bread and other food from being mixed with the juice, and to preserve for the press the ripest and most saccharine grapes.

5th, The tails of the grapes ought to be cut very short, and the operation ought to be performed with a pair of

good scissars. In the *Pays de Vaud* the grapes are detached by means of the nail, in Champagne a pruning-knife is employed: but the two last methods are attended with the inconveniency of shaking the stem.

6th, No grapes ought to be cut but those sound and ripe: those which are putrid ought to be rejected, and those still green must be left on the twigs.

In all places where the cultivators are desirous to obtain wines of a good quality, the grapes are collected at two or three different times. In general, the first vat-full of juice is always the best. There are some countries, however, where the grapes are almost collected without distinction, and at one time; the juice is expressed without picking, but the wines are very inferior to what they might be, if more care were employed in the operations of the vintage.

When the grapes are to be picked, the following rules may be observed: To cut only those clusters which are best exposed, those the grapes of which are equally large and coloured; to reject all those which have been sheltered, and near the ground; and to prefer those which have ripened at the bottom of the vines.

In the vineyards which furnish the different kinds of Bourdeaux wine, the grapes are carefully picked; but the method of picking the red grapes differs from that employed for picking the white: in picking the white, neither the putrid nor the green grapes are collected; in regard to the white, the putrid and the ripest are preferred, and the picking is not begun till a great many of the grapes have become putrid. This operation is so minute in certain districts, such as Sainte-Croix, Loussiac, &c. that the vintage there continues two months. In Medoc the operation of picking is performed twice for the red wines; at Lagnon it is performed three or four times;

for the white grapes at Sainte-Croix, five or six; at Langoiran from two to three; and two in all the Graves.

In some countries a vintage composed of grapes perfectly ripe is dreaded. The cultivators apprehend that the wine will be too sweet, and they remedy this inconvenience by a mixture of large grapes less ripe. In general, the wine is not brisk and pungent, but when grapes are employed which have not acquired perfect maturity. This is what is practised in Champagne and other places.

In some countries where the grapes never come to absolute maturity, and consequently cannot develope that portion of saccharine principle necessary for the formation of alcohol, the cultivators proceed to the vintage before the appearance of the hoar-frosts; because the grapes still possess a sharp principle, which gives a peculiar quality to the wine. It is observed in all those places, that a degree more towards maturity produces wines of very inferior quality.

7. When the grapes are cut they ought to be put into baskets; taking care not to employ any of too large a size, lest the juice should be lost by the superincumbent weight. As it is very difficult, however, to transport the grapes from the vineyard to the vat without altering them by pressure, and consequently without expressing more or less of the juice, baskets ought not to be employed but to receive the grapes as they are cut; and when full they ought to be emptied into boxes or scuttles, that they may be more conveniently conveyed to the vat. They ought to be carried in carts, or on the backs of men, or of mules: which of these three means are to be employed must be determined by local circumstances. Carts are, no doubt, less expensive, though attended with this inconvenience, that the grapes may be injured by the re-

peated shocks they experience: the motion of a horse is gentler, as well as more regular. Scuttles are employed in all countries where the grapes are not very ripe, and where there is little danger of their being injured by the carriage.

(To be continued.)

No. 26.

Agenda; or a Collection of Observations and Researches the Results of which may serve as the Foundation for a Theory of the Earth. By M. DE SAUSSURE.

(Continued from page 130.)

CHAP. VI.

Observations to be made on Rivers and other Currents of Water.

1. EXTENT of their course, and their inclination from their sources to their mouth.

2. Their dimensions, breadth, depth, and velocity in the different parts of their course.

3. Quantity of their periodical increase and decrease at different seasons; their temperature during these seasons; and the causes of these variations.

4. Limits and causes of their extraordinary inundations.

5. Whether they are navigable, and to what distance from their mouth?

6. The nature, purity, and salubrity of their waters.

7. The nature of the sand or mud which they carry along with them; and to what distance they may be traced on the banks or at the bottom of the sea where

their mouths are situated. M. Besson even wishes that the traveller should be furnished with a wooden vessel *(sebille)* to wash the sand and separate the more ponderous particles, which may consist of metal or precious stones. The motion of the waves is also often sufficient to separate, in distinct bands or zones, particles of different gravity.*

8. Nature of the rolled pebbles found on their borders.

9. The quantity and kinds of fish by which they are characterised.

10. To inquire, as in regard to the sea, whether it appears that they contain more or less water than formerly, and whether they have changed their courses.

11. As the greater part of these qnestions may be applied to lakes, it is not necessary to make them the subject of a separate chapter. I shall insist only on their nature and the measure of their depth; on the temperature of their bottom compared with that at their surface in different seasons; and also on the vestiges of their extent and height in the remotest ages, compared with their present state.

CHAP. VII.

Observations to be made on the Plains.

1. The extent, limits, and inclination of a plain; its height above the level of the sea; its relaton with the hills or mountains by which it is bordered. To form a proper idea of it as a whole, it would be necessary to ascend some eminence commanding a view over it.

2. The vegetable earth; its nature and thickness in different parts, compared with the time since it has been

* Moyens de rendre utiles les voyages des naturalistes. Esprit des Journaux, Avril, 1794.

cultivated, with its productions, and the kind of culture. The nature of the basis on which that earth rests.

3. Rolled pebbles. (*See Chap.* VIII.)

4. Sand, argil; their nature; thickness of their beds.

5. Nature and thickness of the strata of the earth at the greatest depth possible to be reached, by taking advantage of the time when wells, mines, and other excavations are dug. This research is particularly interesting when these excavations are extended below the level of the sea.

6. Marle-pits; their external appearances; whether they contain shells, and of what kinds; extent of their beds, and their thickness; analysis of them, at least with acetous acid; the uses for which the marle is employed.

7. Clay-pits; quarries of lime-stoue, gypsum; mines of coal, &c.

8. Whether the plains exhibit at their surface, or contain in the interior parts of the earth, vestiges of marine bodies, petrified wood, bones, or other substances foreign to the soil and to the country.

9. Internal temperature of the earth, ascertained either by direct experiments, or by observing that of the deepest wells or cellars; or by that of springs, which do not freeze in winter, and which remaining cool in summer, seem to come from the greatest depths.

10. Whether any fact can be observed which might oblige us to have recourse to the hypothesis of a central fire.

11. Basons surrounded by hills or mountains; whether they seem to have been formerly filled with water; whether the water appears to have been fresh or salt; whether any thing indicates the period of its retreat, and if there are any traces of the apertures through which it escaped.

CHAP. VIII.

Observations to be made on Rolled Pebbles.

1. The nature and size of those found in any particular district.

2. To examine, above all, whether there is any kind which may be considered as peculiar to that district, or which may be proper to characterise it; or even, whether the absence of any kind or class might not be sufficient to form that character.

3. Whether those found on the borders of any river might be considered as having been thrown up by that river, or whether it only exposed them to view by washing away the soil which it watered.

4. After establishing the character of the pebbles of a certain district, one might follow, as it were, their traces, and form conjectures both respecting their origin and the route they have pursued.

5. The increase of their size will show that they approach their origin, or *vice versa;* but care must be taken that other veins of pebbles crossing the former may not conceal the course of those which you are tracing out.

6. A consideration of the pebbles, and still more that of rolled blocks, or, at least, such as are foreign to the soil which bears them; of the height at which they are found, and of the large valleys opposite to their present situation, may afford some indications of the direction, size, and force of the currents produced by the grand revolutions of the earth.

7. A consideration of those blocks which rest on solid rock, and which seem still to occupy the place where they were deposited, may, by the state of these rocks, give an idea of the time elapsed since their arrival.

8. How far can the transportation of these great blocks

to considerable distances be considered as a general phenomenon? or, is it only a particular phenomenon, arising from some local cause?

9. Can it be believed that such of those blocks as at present occupy elevated sites on mountains, have been transported by billows or waves, which raised them gradually from the bottom of the valleys, and that they must at first have descended to these elevated situations.*

10. Or was it by enormous tides, of eight hundred toises, for example, that these blocks were transported to the tops of the mountains?

CHAP. IX.

On Mountains in general.

1. To consider whether a mountain be insulated, or whether it forms part of an assemblage of mountains connected with each other in the form of groups or chains.

2. If it be a group, to determine its form and dimensions, and the manner in which its parts are connected.

3. If it be a chain, to determine its direction, its breadth, and its extent; whether it be single or compound; and, in the latter case, the nature and disposition of the partial chains which enter into its composition.

4. If a mountain be insulated or considered separately from its chain, or the group of which it forms a part, to determine its form, its height, and other dimensions.

5. To determine the form and situation of its summit or most elevated part; those of its declivities and bottom.

* May not the transportation of these blocks, at least in cold countries, be ascribed sometimes to floating ice? TIL.

6. The situation of its precipices in regard to the sea and the nearest plains, valleys, and mountains.*

7. Its nature, and the kind of stone of which it is composed. Whether it be homogeneous; that is to say, of the same nature throughout all its parts; if it be not, to determine the dimensions of its different parts.

8. Whether it consists of indivisible masses, or masses divided by strata.

9. Whether it contains mines either in veins or strata: the nature of these mines.

10. To observe the height at which the snow is perpetual, or what Bouguer calls *the lower limits of the snow*, and the height at which trees, shrubs, and plants, with distinct flowers, cease to grow. These observations have been neglected in the northern countries.

11. To observe carefully the increase or decrease of the glaciers: to determine them, in particular, by what are called *moraines*, that is to say, those heaps of stones now or formerly deposited by the glaciers on their edges and at their extremities.

11. A. To ascertain whether there are found in the mountains sunk or petrified trees, at heights at which they would not grow at present; and to examine if it thence follows that there may have been a time when the upper strata of the atmosphere were warmer than they are at present.

12. Caverns: if there are any, their form and dimensions; the nature of their sides; the nature and inclination of their bottom; vestiges of the effects of the water by which they may have been formed; stalactites and incrustations, foreign bodies and bones which they may contain.

13. Whether there are found vestiges of large basons

* And in regard to the four cardinal points; whether any side is more steep than another, and which side? TIL.

disposed in stories above each other, and which might have served as reservoirs to different seas that afterwards might have run off and united themselves in the basons of the present seas.

CHAP. X.

Observations to be made on the Strata of the Earth and Mountains.

1. The first question is to determine whether a mountain or any mass of earth and stone is or is not divided by strata.*

2. What, in regard to the theory of the earth gives importance to the question, whether a mountain is or is not stratified, or composed of strata, is the supposition that stratified mountains have been formed by the successive deposition of substances before suspended in a fluid, while those which exhibit no signs of strata may be supposed to owe their origin to a simultaneous creation, or an accumulation not formed in a fluid, or which, at least, had nothing successive or regular, or in which there remain no traces of regularity.

3. If the mountain or mass exhibits no marks of division, the question of its being stratified or not is superfluous. We shall suppose then that it presents divisions, and require to know whether these divisions may be called *strata*. The solution of this question depends upon three considerations: viz. The regularity of these divisions, or their parallelism. Their number: the greater the number, the more it excludes the idea of fortuitous

* The word *stratum*, originally synonimous with that of *bed*, expressed the situation of a substance extended horizontally, and with an uniform thickness, on a plain and horizontal base. But the signification of this word has been enlarged, and it is now employed to express the situation of substances extended with an equal or almost equal thickness on bases which are neither plain nor horizontal. *Note of the Author.*

Might not the term *stratum* be reserved for those that are horizontal, and the name of *banks* be given to others? TIL.

parallelism. The parallelism of these divisions with the laminæ or parts discernible in the inside of the mass.

4. Though the strata, in general, have the form of a parallelopipedon, some are seen cuneiform; in others are observed alternate swellings and constrictions; and others are seen ramified, dividing themselves sometimes into two or three, or two and three uniting and forming themselves into one.

5. Besides the form of the strata, to observe their extent, either in the same mountain, or in several mountains near each other, or even at a distance.

6. To observe also their inclination, or the angle which they form with a horizontal line, and the point of the horizon to which their declivity is directed.

This last observation determines the direction of their planes, or the two opposite points of the horizon through which their planes would pass, were they prolonged, after being made entirely straight. This direction of the planes is of importance to be considered, especially in vertical strata.

7. To examine whether this direction is parallel, oblique, or transverse to the direction of the body itself of the mountain, the chain of which it makes a part, and the adjacent valleys.

8. To examine also whether the declivity of the strata is conformable to that of the external surface of the mountain; that is to say, whether they descend towards the outside of the mountain, or towards the interior part.

9. To examine next whether the inclination is the same from the bottom of the mountain to the summit, or whether it varies at different heights; whether it be the same or different at the opposite sides of the same mountain. Strata in the form of a fan.*

* Voyages dans les Alpes. § 656 and 677.

10. It is of importance to observe, in inclined or vertical strata, whether their thickness is not greater at their basis than at their summit.

11. To observe the joinings of the strata, and whether any substance different from that of the strata is placed between them, and what is the nature and thickness of this substance.

12. To observe whether the contiguous or corresponding joinings of these strata are smooth or unequal; whether there are observed in them any knots that exhibit traces of crystallization or undulations proceeding in a certain direction.

13. In mountains consisting of strata different in their nature, or of different thickness, to observe whether their return is periodical, so that the same order recommences after a certain number or determined interval.

14. Whether, at the bottom of a mountain consisting of horizontal strata, there are not found mountains composed of vertical strata resting against the basis of that mountain.

15. In bent or circular strata, to observe in the elbows or points where the flexion is greatest, whether the strata are or are not broken.

16. When the strata have the form of a C, to observe whether at the back of the C there is not a vacuity, which proves that the upper part has been thrown above the under part.

17. To examine, in general, whether the strata exhibit traces of violent convulsions, which may have changed their primitive situation; or, on the contrary, whether the whole, as well as the straightening of the strata, may be explained by simple sinking down.*

* 18. To observe, whether, on approaching the high primitive mountains, the calcareous strata do not seem to have been reversed in a more violent manner. B.

CHAP. XI.

Observations to be made on Fissures.

1. Their form, dimensions, breadth, extent, and direction.

2. Their situation; measure of their inclination; direction of that inclination in regard to the cardinal points, and in regard to the adjacent mountain and valleys.

4. To observe, above all, the direction of fissures in regard to that of the planes of the strata; because fissures, as is presumed, being produced, in general, by the earth sinking down, and this sinking down being the effect of pressure, fissures have been originally vertical or nearly so; and, on the other hand, because the strata having originally been horizontal or nearly so, the situation of fissures, in regard to the strata, and the direction of both in regard to the horizon, may give some idea of the situation which the strata had when the fissures were formed, and even of the changes of situation which the mountain afterwards experienced.

Thus, fissures perpendicular to the planes of the strata, indicate that these fissures were formed when the mountain was still in its primitive situation; and if they are also perpendicular to the horizon, it proves that the mountain is still in the same situation: but if fissures perpendicular to the strata are inclined to the horizon, we may conclnde that the mountain has changed its situation since these fissures were formed.*

5. When the fissures are filled with matter different from the body of the mountain, that matter is called a vein.

6. Lastly, one must examine, in both sides of the same

* An explanation and application of these principles may be seen in my Travels, § 1048, 49, 50, and 1218.

fissure, whether the strata correspond at the same height, or whether the corresponding strata are lower on one side than on the other. The first case indicates that the fissure has been produced by mere bursting asunder; and the second proves, besides, a sinking down of the earth.*

CHAP. XII.

Observations to be made on the Valleys.

1. To observe the direction of valleys. Those parallel to the chain of the mountains where they are situated are called longitudinal; those which intersect it at right angles, transversal; and those which follow an indeterminate direction, oblique.

2. To observe this direction, especially in regard to that of the planes of the strata of the mountains.

3. Dimensions of the valleys; their length, breadth, depth, and the form of their transversal section.

4. The re-entering and salient angles: whether opposite to each salient angle, which forms a side of the valley, the side or opposite mountain forms a re-entering angle; or, on the other hand, whether the valley does not present alternate constrictions and swellings?

5. Whether the opposite mountains correspond by their height, their form, the inclination of their corresponding faces; the situation of their strata, or their nature?

6. Answers to these questions will serve to determine whether the valley may or may not be considered as a large fissure produced by the bursting asunder of the mountains which it traverses.

7. If the lateral valleys which terminate at a principal valley, as the branches of a tree at its trunk, correspond

* To observe whether this sinking down has not always taken place on that side which looks towards the flat country. TR.

or not; or, in other words, whether the branches of that trunk are opposite or alternate?

The answers to these two questions are very important for the solution of this question: Whether the valleys have been excavated by currents of the sea?

9. Whether there are seen a great number of narrow valleys, of no great depth at their most elevated part, but becoming wider and deeper in proportion as they descend lower, which would seem to indicate that their excavation has been the effect of the fall and descent of water; especially if the strata have the same inclination on each side of the valley, and if its formation cannot be explained by a sinking down or heaving up of the earth.

10. To observe in a valley, the corresponding mountains of which are of the same nature, whether the strata of these mountains do not descend on each side towards the bottom of the valley, which would indicate that the valley has been produced by a sinking down of the earth, or perhaps by the opposite faces being thrown up.

11. There are two other cases possible when the strata have not the same situation on both sides of the valley. 1. When the strata rise up on each side against the valley. 2. When on one side they descend into the valley, and on the other rise against it. These two cases afford room for suppositions too various to be here detailed.

12. To search on the vertical sides of the valleys for vestiges of the erosion of the water.

13. To observe the bottom of the valley, its breadth, inclination, and nature. The vegetable earth, its quantity and quality; fragments, either from neighbouring mountains, or brought from a distance, either angular or rounded; to examine whether they are more voluminous towards the top of the valley. Nature and depth of the

strata which are below the vegetable earth; whether the pebbles are larger in the deepest strata: nature of the rock which forms the solid basis of the valley.

14. Whether a valley contains foreign pebbles, that is to say, which come from the neighbouring mountains: to examine to what height they are found on the sides of the mountains; what may be their origin, and what way they may have been conveyed.

15. In the valleys which contain no foreign pebbles, one may follow the traces of those which are there discovered, and thus ascend to the rock from which they were detached: this has often led to curious and useful discoveries.

CHAP. XIII.

Observations to be made on Tertiary Mountains, or those composed of the Wreck of other Mountains.

1. Whether they do not form the external border of other chains of mountains.

2. Whether, at the extremity of great valleys which issue from grand chains of mountains, there are not found small hills and even tertiary mountains, which seem to have been formed by the accumulation of matters deposited by enomous currents that issued formerly from these valleys.

3. Whether their strata do not descend on the side, whence the matter of which they are formed has proceeded?

4. Size and nature of the fragments, sand and earth, of which they are composed.

5. To observe the order which has been followed in the successive deposits of the matters of which they are formed.

6. To compare them with the substances produced by

the mountains, whether primitive or secondary, from which they are supposed to have issued.

7. To examine whether there are found there any vestiges of organized bodies.

8. To examine whether there are not found, in their exterior part or surface, strata that seem to have been deposited by stagnant water, or at least water not much agitated; or, on the contrary, whether every thing in them seems to have been transported by some violent movement?

CHAP. XIV.

Observations to be made on Secondary Mountains.

1. To determine with precision the distinguishing characters between primitive and secondary mountains. This is difficult, especially in the genera found equally in primitive mountains, such as slate, serpentines, and some kinds of *trapps* and porphyry. With regard to the calcareous, a granulated fracture seems to characterize the primitive. M. Fichtel, however, doubts this principle, and believes that there are secondary granulated, calcareous, and compact primitives.

2. Is it certain, as Dolomieu asserts, that in secondary mountains there are no strata composed entirely of granulated and crystallized stones?

3. To determine the respective antiquity of the genera and species of the earths and stones which enter into the composition of secondary mountains. Might we not assign characters by which, in the same genus, we might distinguish the most modern species and varieties?

4. Whether the secondary mountains are always inclined in such a manner as to lean towards the nearest primitives?

5. Whether their superior stratum, especially in the

compact calcareous, is not often a *breche*,* the angular fragments of which are for the most part of the same nature as the stratum that serves them as a basis, and united by a cement of the same nature? †

5. (A). To observe in the chalk mountains the flints contained there; their bulk, their form, &c.; whether they are disposed in beds; to reflect on their origin: even researches on the petro-silex contained in the compact calcareous stones; and, lastly, the same on the hard *rognons*, or touch-stones contained in the slate mountains: to ascertain whether these petro-silex and rognons are not found in the primitive mountains.

6. Whether there are found in secondary mountains vestiges of organized bodies, and at what elevation. This observation is important above all in the Austral hemisphere.‡

7. Whether there are found, either at their surface, or in their interior parts, rolled pebbles or blocks of a nature different from that of the same mountain, and to what height? ‖

8. Whether these mountains seem to have been formed by the alluvion of violent tides, or by the accumulated deposits of stagnant water?

9. Whether the secondary mountains do not present themselves sometimes in vertical strata, or at least strata very much inclined, and with sharp naked peaks like those of some primitive mountains?

10. Whether, in the same secondary mountain, there are found strata of different kinds of stones oftener than in the primitive?

* Breche is a kind of hard marble found in the Pyrenees.

† Voyage dans les Alpes, vol. i. § 242. A. and 243.

‡ 6. A. Do not organized bodies contribute sometimes to the hardness of stones, especially those that contain iron, by bringing that iron near to the metallic state? *Hypothesis of Gad in Mem. of the Acad. of Sweden*, 1787. Tr.

‖ See Dolomieu's Memoir, Journal de Physique, 1791, vol. ii.

11. Whether, in secondary mountains, on the other hand, each stone is not generally simple, and not compound as in the primitive?

12. To make researches respecting the origin and antiquity of mountains of gypsum, and their relation with mountains of salt and salt springs.

(To be continued.)

Observations on Maddering; together with a simple and certain Process for obtaining, with great Beauty and Fixity, that Colour known under the Name of the Turkey or Adrianople Red. By J. M. Haussmann.

(Concluded from page 146.)

The Process.

After making a caustic ley of one part of good common potash dissolved in four parts of boiling water, and half a part of quicklime, which I afterwards slaked in it, I dissolved one part of powdered alum in two parts of boiling water; and while this solution of sulphate of alumine was still warm, to avoid re-crystallization, I speedily poured into it successively, always stirring it without interruption, the above-mentioned caustic ley, till the alumine it had at first precipitated after saturation to excess with sulphuric acid had been redissolved. I left at rest this solution of alumine, which exhaled ammonia, and which, on cooling, formed a precipitate of sulphate of potash in very small crystals. I then mixed a thirty-third part of linseed-oil, with which the alkaline solution of alumine formed a kind of milky liquid.* As the oil gradually separates itself from this mixture under the ap-

* In fact, a saponaceous liquor is formed containing alumine. Tr.

pearance of cream, it must not be employed till it is again shaken. The skains of cotton or linen ought to be successively immersed in it, and equally pressed, that they may be then exposed to dry on a pole in the order in which they have been taken from the mixture. They must be dried under shelter from rain in summer, and in a warm place in winter, and be left in that state for twenty-four hours: they must then be washed in very pure running water, and be again dried; after which they are to be immersed in an alkaline ley, pressed and dried a second time in the same manner as the first, taking care, however, to recommence the immersion in the ley with those skains which have been last in the oily mixture, because the first never fail to carry away a larger portion than the last: it will be proper also to consume the mixture each time, that it may not have leisure to attract the carbonic acid with which the lower region of the atmosphere is always charged, especially in manufactories; for the alkali, by passing to the state of carbonate, suffers the alumine to be precipitated, and loses the property of mixing with the oil.

Two immersions in the alkaline solution of alumine mixed with linseed-oil will be sufficient to obtain a beautiful red; but, by continuing to impregnate the skains a third and even a fourth time with the same circumstances as the first, colours exceedingly brilliant will be produced.

The intensity of the red proposed to be obtained will be in proportion to the quantity of the madder employed. By taking a quantity of madder equal in weight to that of the skains, the result will be a red, which, by clearing, will be changed to a rosy shade: on the other hand, shades of crimson, more or less bright, will be obtained by employing two, three, and even four times the weight madder, without ever forgetting the addition of chalk, if

the water employed does not contain some of it. Four parts of this colouring substance will produce a red too intense and beautiful to be employed in commerce, as it would be too dear to find purchasers.

By making an oily alkaline solution of alumine with two or three parts of water, and impregnating the skains twice, and even four times, in the manner above mentioned, bright shades will be produced without the use of much madder; but they will not have the same intensity as those procured with even as little madder by means of the same solution concentrated.

The best method of obtaining shades lively as well as bright, is to expose the dark reds for a considerable time, when they have been cleared, to the action of a ley of oxygenated muriate of potash, or of soda with excess of alkaline carbonate, in order to have such a degree of shade as may be required: but it may readily be conceived that this method would be expensive.

To have the oily alkaline solution of alum nearly in the same state of concentration, it will be necessary to employ an areometer to determine the degree of strength of the caustic ley before it is employed for the solution of the alumine. This caustic ley must be made with the best common potash that can be procured, and the degree it gives by the areometer must be noted, in order that, if potash of an inferior quality be afterwards employed, the ley obtained may be carried to the fixed degree by evaporation.

Caustic ley made with four parts of good common potash* cannot contain a large quantity of foreign salts. By making it on a large scale, when the limpid part has been decanted, it will be necessary to shake the deposit, for some time, twice every day, that the rest of the alka-

* I have no doubt that, where potash cannot be procured, soda might be employed. The Author.

line liquor may be decanted; and that none of what still remains in the deposit may be lost, it ought to be diluted with more water, which may be afterwards employed to lixiviate the cotton, which must be well purified and cleaned before it is dyed; which may be done by lixiviating and soaping, or merely boiling it in water, and then rinsing and drying it. As wringing with the hands may derange the filaments of the skains of cotton and linen, and consequently weaken the thread, it will be proper, in operating on a large scale, to squeeze them by means of a press.

In regard to thread or linen to be dyed of a beautiful dark and fixed red, it must be well bleached, and impregnated at least four times successively with the oily alkaline solution; because, not only alumine and metallic oxides adhere with more difficulty to linen than to cotton, but because these mineral substances, when coloured, abandon linen much easier than cotton when clearing. It still remains to examine whether, between each impregnation with the oily alkaline solution of alumine, cotton or linen thread requires to be left at rest for a greater or shorter time before it is rinsed and dried.

All fat oils may be employed in the mixture with proper precautions; but linseed-oil mixes better, and remains longer suspended in the alkaline solution of alumine: I never tried fish-oil, which, perhaps, would be preferable. It is probable also, that in operating on a large scale, it would be best to diminish the quantity of linseed-oil in the mixtures with the alkaline solution of alumine; for I have had reason often to observe that too much oil hurts the attraction of the colouring parts of the madder: a thirty-third part of linseed-oil always produced the best effect in my trials on a small scale.

In regard to the process of dyeing cotton and linen thread, sufficiently charged with alumine, by the oily al-

kaline solution of that earth, the skains must first be disengaged from every saline substance, as well as from the superfluous oil, by rinsing them a long time in very pure running water; after which they must be arranged, without drying them, on an apparatus, which the operator may construct according to the form of the boiler,—in which it is to be placed in such a manner, that during the process of dyeing, the skains may be continually shaken and turned, in order to catch every where, and in an uniform manner, the colouring particles. The bath must be composed of madder, mixed with a sixth of pounded chalk, and diluted with about 30 or 40 parts of water. The heat must be carried only to such a degree that the hand can be held in the bath for an hour without being scalded; and it is to be maintained at this degree for two hours, either by diminishing or increasing the fuel. Three hours dyeing will be sufficient to exhaust the madder: the skains when taken from the bath must be washed in a large quantity of water to cleanse them; they are then to be cleared by boiling them a pretty long time in water containing bran inclosed in a bag, adding soap and alkaline carbonate to give the red a rosy or carmine shade.

As I never had occasion to dye cotton or linen thread on a large scale, I employed a small boiler, which served me at the same time for the process of clearing: in the latter operation I confined myself to boiling the skains, properly arranged, in water containing a bag filled with bran, for eight hours successively; and, that I might not interrupt the ebullition, I replaced the evaporated part by the addition of more boiling water. In this clearing I employed neither soap nor alkali; yet I obtained a red superior in beauty and fixity to that of the Levant, and which, in every respect, will bear a comparison with the best colours dyed in France.

For dyeing my red, I employed three parts of the best madder for one part in weight of dry cotton thread.

With the precaution I took to obtain an uniform shade I could have dyed at one time, but I should always recommend performing this operation at two different times, taking each time half a portion of madder and of chalk, if the skains cannot be continually turned in the boiler: it may serve also for clearing, by adapting to it a cover so as to suffer very little of the vapours to escape, because it would be too expensive to replace the part evaporated by more boiling water. By operating on a large scale, and concentrating the heat in the boilers, keeping them almost close, there, perhaps, would be no need of employing eight hours ebullition to clear and fix the colours. I have every reason to believe that this clearing of the Turkey red gave rise to the idea of bleaching with steam: it must have been seen that colours by being cleared lose considerably in regard to their intensity; and perhaps it has been observed at the same time that the packthreads employed for arranging the skains were bleached during the clearing, especially when alkalies were added.

A great variety of colours and of different shades may be obtained by following the process here described for obtaining beautiful and durable reds. In this case, the oily alkaline solution of alumine must not be employed till the required shade of oxide of iron or indigo blue has been given; but whatever may be the colour or shade which you wish to give, before you fix the alumine on the skains of cotton or linen, these skains must always be first well boiled, by which means the adhesion of the indigo fecula as well as that of the oxide of iron will be increased, in the same manner as that of alumine coloured by the colouring parts of madder when subjected to the action of the heat of boiling water before they are

impregnated with the oily alkaline solution of alumine. As the method of dyeing indigo blue in all its shades is well known, it is needless to detail it; and as to giving a rusty yellow colour, which may be done at little expense, nothing is necessary but to moisten the skains well with a solution of the sulphate of iron, to press them equally, and then to immerse them in a caustic ley of potash, which will precipitate and fix the oxide of iron of a disagreeable colour, but which will not fail to assume a rusty yellow shade by attracting and becoming saturated with the oxygen of the atmosphere: thus yellow will be more or less dark according to the quantity of the sulphate of iron in solution. More intensity and even more equality may be given to the rusty yellow by moistening the skains a second time in the ferruginous solution, and immersing them in the caustic ley. Care, however, must be taken not to use soda for this operation, because it generally contains sulphur, which blackens oxide of iron by mineralizing it.

The skains coloured blue and rusty yellow, treated with oily alkaline solution of alumine, will produce, by maddering, dark purple and chamois colours, violet, lilac, puce, mordoré, &c. It may be easily conceived, that if, instead of maddering, the same skains prepared for maddering be dyed with kermes, cochineal, and Brazil wood, logwood, wood of St. Martha, woad, yellow wood, quercitron, yellow berries, &c. a great variety of colours will be obtained: the shades may even be varied *ad infinitum* by mixing the colouring ingredients with each other in different proportions. The affinity of adhesion of the colouring parts of all these ingredients varies also to such a degree, that the shades arising from a yellow or olive-green will be changed or totally metamorphosed by a second dyeing with madder, kermes, cochineal, or Brazil wood; and will furnish orange shades, capucine,

carmelite, burnt bread, bronze, &c. As the preliminary preparation of the skains by the oily alkaline solution of alumine might be too expensive for some of these colours, the process I described in the *Annales de Chimie* for the year 1792, p. 250, may be substituted in its stead. This process consists in treating the skains alternately with soap and sulphate of alumine, the excess of the acid of which has been saturated with one of the alkaline carbonates or with lime: this method is very expeditious. In the course of a day, especially in summer, the skains may be prepared and dyed red as well as other colours; which, for the most part, may be subjected to ebullition, and will bear clearing with bran for a quarter or half hour, and even some of them for a whole hour. It is also to be observed that there are none but madder colours, the alumine and oxide of iron bases of which have been fixed on the stuffs by means of the oily alkaline solution, that can acquire perfect fixity by the action of heat of boiling water; and that the fixity is very inferior in all madder colours the earthy and ferruginous bases of which have been applied to stuffs by means of acid solvents.

Alumine, fixed in abundance on cotton or linen stuff by means of a highly concentrated alkaline solution, attracts very easily the colouring parts in the process of maddering. The case is not the same when the same earth is applied by the most highly concentrated acetic solution of alumine; and it is absolutely impossible to finish maddering at one time, even when a profusion of madder is employed, and the operation is repeated three and even four times.* This circumstance will give rise to new and interesting experiments; but my observations prove in the mean time that maddering, in general, requires to be managed with the nicest attention.

* Concentrated acetic solution of oxide of iron is attended with nearly the same difficulties.

No. 28.

Description of an Improvement in Jury Masts. By Capt. William Bolton, *of the Royal Navy.**

(With a Plate.)

SIR,

Herewith you will receive the model of a plan for fitting ships' jury masts, to be formed from the spare spars usually carried on board king's ships, and in every merchantman that is properly found. By having jury masts so fitted, ships will be enabled to carry as much sail as on the usual regular mast; the great use of which I need not dwell on, only observing that it may be of great importance to fleets after a general action, or when in want of proper lower masts, either at home or abroad, and enable ships, after the loss of their mast, to prosecute their voyage, or service, without any deficiency of sail.

I beg you will be pleased to lay it before the Society, and I have the honour to be,

Sir, your obedient humble servant,

Wm. Bolton.

Oct. 31, 1807.

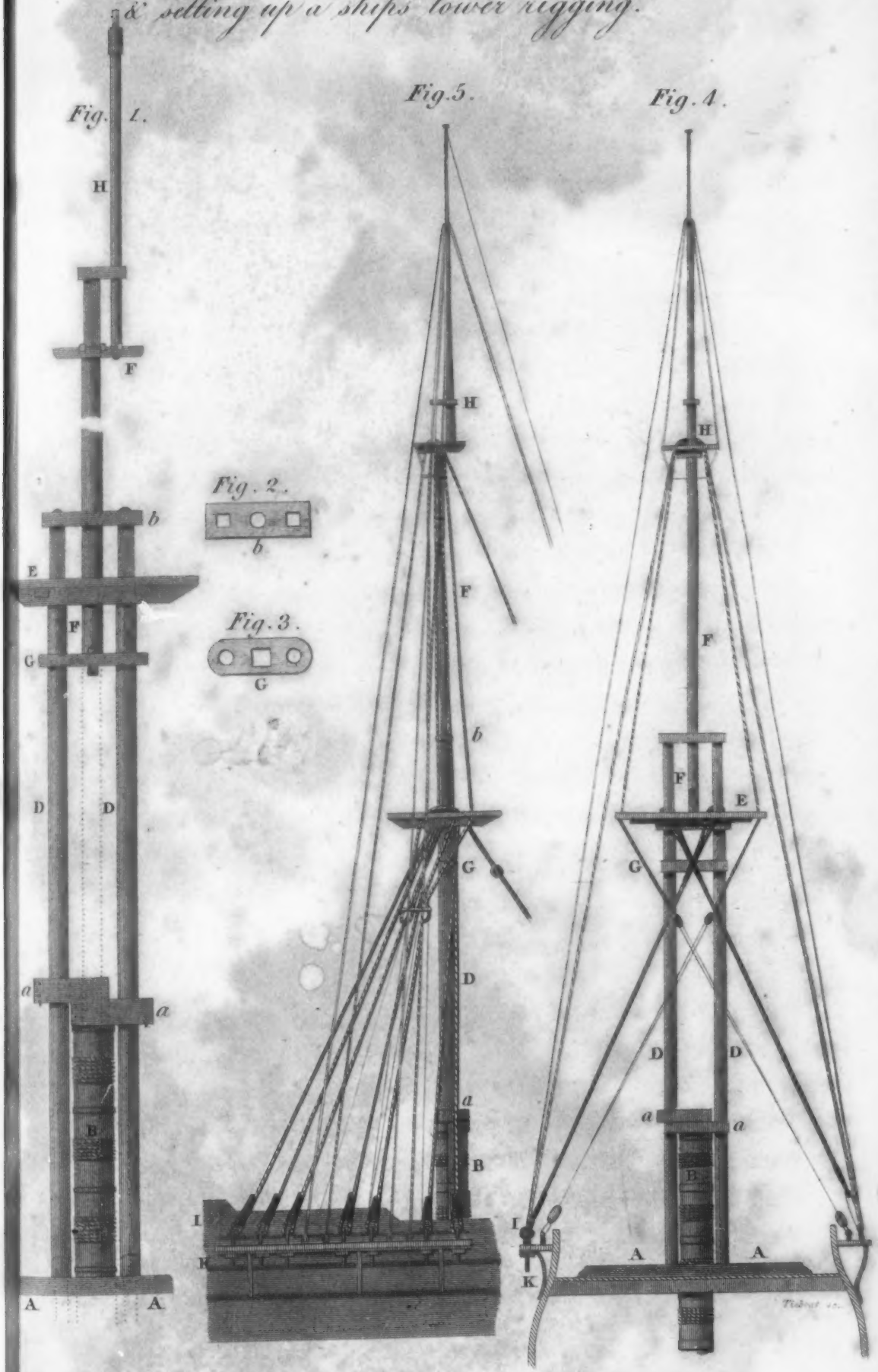
C. Taylor, M. D. Sec.

REMARKS.

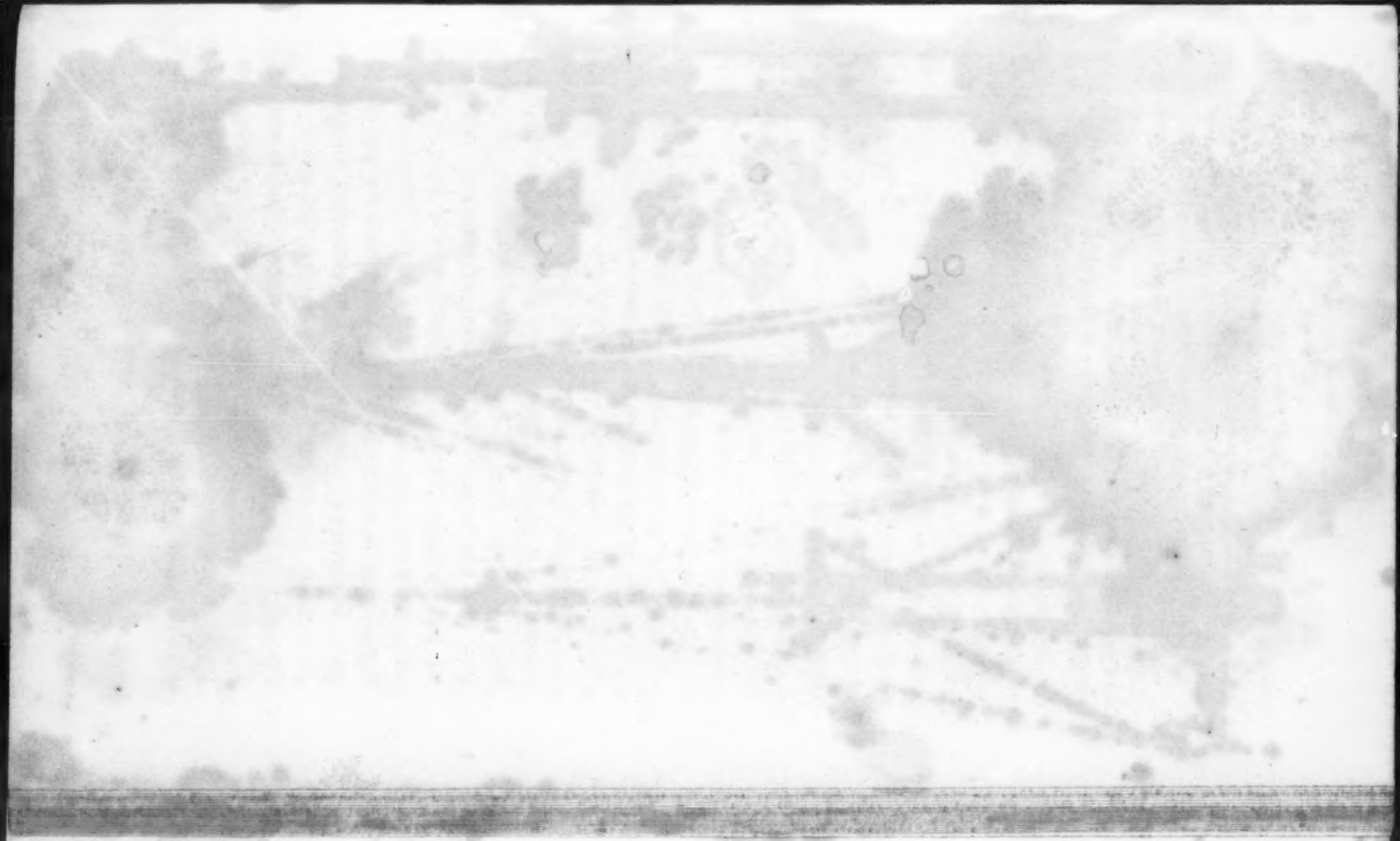
In the model in the Society's possession the main mast is broken about one-third of its length above the deck, proper partners are secured on the deck, in which a hand mast and a spare main top mast are fixed on each side of the broken main mast, and secured thereto by two spare caps, morticed on a square made in its centre. A strength-

* Tilloch, vol. 33, p. 346. From Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, for 1808.——The silver medal of the Society was voted to Capt. William Bolton for this communication.

Bolton's improved Jury Mast with his mode of rigging it & setting up a ships lower rigging.



Emporium of Arts & Sciences - Vol. 1. Pl. 5.



ening cap, moveable on these additional masts, connects them, and the upper parts of these masts are secured firmly by trustle trees in the main top. The foot of a spare fore top mast passes through a cap made from strong plank, morticed into the heads of the two temporary masts above mentioned, goes through the main top, and rests in the moveable strengthening cap, which connects those two masts, and enables the fore top mast to be raised to any height which the main top will admit, and be then firmly secured by the upper cap, the main top, and the strengthening cap below it. The fore top mast being thus adjusted, the cross trees and top gallant mast are mounted upon it, which completes the whole business.

Two caps are the only things necessary to be made expressly for the purpose, the other articles being usually ready on board the ship.*

No. 29.

Letter from Capt. William Bolton, *of the Royal Navy, on his improved Jury Masts, and on a Contrivance for better securing the Shrouds of Ships.*†

(With a Plate.)

SIR,

Finding some doubts were entertained relative to the practicability of rigging jury masts, upon the plan I had

* The references to the Engraving in this communication are the same with those that are given at the end of the next paper by the same gentleman; they are therefore omitted here. Ed.

† Nicholson, vol. 25, p. 357. From Trans. of Soc. of Arts, vol. 27, p. 189. Some doubts having arisen as to the practicability of rigging Captain William Bolton's improved jury masts, described in vol. 26, page 167, of the Society's Transactions, (see preceding paper,) he in consequence has sent to the Society another model thereof completely rigged, which obviates all difficulty therein; and likewise has added another invention of his contrivance, for the better securing the shrouds of rigging; explanatory engravings of both are annexed, and the model is preserved in the Society's Repository. The gold medal of the Society was voted to Captain Bolton for his naval improvements.

the honour to present to the Society in Oct. 1807, I beg you will lay before them a model completely rigged; from which it will appear, that the rigging so placed will give, from the angle being more obtuse, greater security, and supersede the necessity of cathur pinning [catharpings], and admit of the lower yards bracing sharper up.

The hint which I gave formerly relating to striking a top mast is now carried into effect, by the mode in which I have fitted the top mast rigging, which admits of its being set up, almost instantaneously, at any point the mast shall descend to; the advantages of which are many, more particularly when the ships are riding hard in open roadsteads; for, by striking the top mast, ships will be enabled to ride much longer at their anchors, and still be ready to make sail on their top masts, according to the state of the weather, which will or ought to determine the distance to which the masts are struck.

In this model I also present to the Society a plan, the earliest of my mechanical pursuits, for setting up a ship's lower rigging, which will be effected by one man; whereas in the ordinary way it is performed by an assemblage of tackles, and the labour of a whole ship's company: the larboard side of the model is fitted up according to the old plan; the starboard side * with my improvement, which consists simply of a screw attached to each shroud, and tightened by a nut under the channels, which should be well secured by iron clamps or knees for this purpose: the expense will be far less than in the common mode; and I do think the bare inspection of the model will be sufficient to establish its superior efficacy.

I will thank you to expunge the passage from page

* The larboard side in fig. 4, of plate 5.

168 in the last volume, after the full stop at *main-top*,* and substitute the following:

"The spare fore top mast passes through a cap made from strong plank, *b*, into the square holes of which the heads of the two temporary masts above mentioned are inserted, and the heel of the top mast is fidded on the tressle trees or top as in common, and the mast rigged as usually. The object of the strengthening cap, G, is to steady the spars, and also serves to fid the top mast on, if thought necessary." I have the honour to be, &c.

WM. BOLTON.

Reference to the Drawing of Captain Bolton's Jury Mast, his Rigged Jury Mast, and his improved Mode of securing the Shrouds.

Plate 5.—Fig. 1, 2, 3, 4, 5.

A A, fig. 4, represent the partners or pieces of timber, which are bolted to the quarterdeck for the mast to rest upon. B is the stump of the lower mast, which is cut square at the top, and of the same size as the head of the mast originally was; upon this square the main and spare lower caps *a a* are fixed; two mortices must be cut in the partners A A, to receive squares made at the lower ends of the two temporary masts D D, which are supported by the caps *a a*, one of them is a spare main top mast, the other a hand-mast; these two support the main top E, additional squares being made on the tressel trees to receive each of them. *b* is a cap shown in fig. 2, made of four-inch plank doubled for the purpose, and fitted upon the heads of the masts D D, for a fore top mast F F, the heel of which, when struck, rests in a mortice made in the stump of the lower mast; it is also steadied by a double cap G, separately shown in fig. 3,

* Emporium, p. 217, line 4 from the top.

on which it fids; as it does finally on the top. The top gallant mast H is fixed to the top mast F by the top and cap in the usual manner. The figures 2 and 3 show the caps separated from the masts, and are the only things necessary to be made for the purpose; and the object of the cap, fig. 3, is to steady and prevent any wringing of the lower jury mast, and to fid the top mast whenever it is reefed. The fore top mast F F, in fig. 1, appears in two separate pieces, on account of its length. In the proposed method of securing the shrouds of ships in general, I represents the screws with loop holes for the shrouds to be lashed to, and K the screw nuts, which by means of a proper wrench may be easily turned, so as to tighten or slacken the shrouds at pleasure. The other side of the ship is shown fitted up in the common way, that the contrast may be observed.

Fig. 1 is the jury mast unrigged, and fig. 5 is a side view of the mast and rigging, in which the same letters refer to the same parts.

No. 30.

Description of a Capstan, that works without requiring the Messenger or Cable coiled round it to be ever surged. By J. Witley Boswell, *Esq. of Clifford's Inn.**

Sir—I request you will lay before the Society of Arts, &c. the model of a capstan contrived by me, which works without requiring the messenger or cable coiled round it to be ever surged, an operation necessary with common capstans, which is always attended with delay, and frequently with danger.

* Nicholson, vol. 21, p. 133. From Trans. of Soc. of Arts, vol. 25, p. 65 For this invention the gold medal was voted to Mr. Boswell.

Capstans of this kind can be made by a common shipwright, and would not be liable to be put out of order. They also would not occasion any additional friction or wear to the messenger or cable, in which particulars they would be superior to the other contrivance hitherto brought forward for the same purpose; they also would much facilitate the holding on.

The great loss of time and great trouble, which always attend applications to the Navy Board, prevent my attempting to bring the matter before the public through that channel, though I have had the most unequivocal approbation of the capstan from the two gentlemen of that board best qualified to judge of it. I mention this, lest it might be thought, that my not applying there first was from any doubt of the goodness of the invention. If the Society should approve of the capstan, I will draw up a more minute account of it for publication. I am, &c.

J. W. Boswell.

Sir—I have examined your model of a capstan, which is calculated to prevent the surging of the messenger when heaving in the cable; it certainly possesses great merit, and the idea to me is quite new. I am, &c.

Nov. 19, 1806. William Rule.

Sir—According to your desire, I transcribe the part of the letter from Mr. Peake (Surveyor of the Navy) to me, which relates to the capstan laid before the Society.

Extract of a Letter from Henry Peake, Esq.

"With regard to your ideas on the capstan; I have "tried all I can to find some objection to it, but confess "I hitherto have been foiled, and shall more readily "forward it, if it was only to supersede a plan now

" creeping into the service, more expensive, and much " worse than one lately exploded."

As you and the members of the Committee have seen the letter, I imagine further attestation needless relative to it.

I request you will mention, that all friction of the revolutions of the cable (or messenger) in passing each other between the barrels of the capstan, must be effectually prevented by the whole thickness of one of the rings that passes betwixt each crossing. I add this because one of the gentlemen of the Committee wished to be informed on this point. I am, &c.

J. W. Boswell.

Sir—In obedience to your intimation, that a written explanation of the advantages to be obtained by the use of capstans made according to the model, which I laid before the Society for the Encouragement of Arts, &c. would be acceptable, I send the following, which I hope will make the subject sufficiently clear.

As few but mariners understand the manner in which cables are hauled aboard in large ships, it will probably render the object of my capstan more manifest, to give some account of this operation.—Cables above a certain diameter are too inflexible, to admit of being coiled round a capstan; in ships where cables of so large dimensions are necessary, a smaller cable is employed for this purpose, which is called the *messenger*, the two ends of which are made fast together so as to form an endless rope, which, as the capstan is turned about, revolves round it in unceasing succession, passing on its course to the head of the ship, and again returning to the capstan. To this returning part of the messenger, the great cable is made fast by a number of small ropes, called nippers, placed at regular intervals; these nippers are applied, as

the cable enters the hawse hole, and are again removed as it approaches the capstan, after which it is lowered into the cable tier.

The messenger, or any other rope coiled round the capstan, must descend a space at every revolution, equal to the diameter of the rope or cable used; this circumstance brings the coils in a few turns to the bottom of the capstan, when it can no longer be turned round, till the coils are loosened and raised up to its other extremity, after which the motion proceeds as before. This operation of shifting the place of the coils of the messenger on the capstan, is called *surging the messenger:* It always causes considerable delay; and when the messenger chances to slip in changing its position, which sometimes happens, no small danger is incurred by those who are employed about the capstan.

The first method that I know of, used to prevent the necessity of surging, was by placing a horizontal roller beneath the messenger, where it first entered on the capstan, so supported by a frame, in which it turned on gudgeons, that the messenger in passing over it was compelled to force upwards all the coils above the capstan, as it formed a new coil.

This violent forcing of the coils upwards along the barrel of the capstan not only adds considerably to the labour in turning the capstan, but from the great friction which the messenger must suffer in the operation, while pressed so hard against the capstan, (as it must be by the weight of the anchor and strain of the men,) could not but cause a very great wear and injury to the messenger, or other cable wound round the capstan; and that this wear must occasion an expense of no small amount, must be manifest on considering the large sums which the smallest cables used for this purpose cost.

The next method applied to prevent surging was that

for which Mr. Plucknet obtained a patent, the specification of which may be seen in the Repertory of Arts, No. 46. In this way a number of upright puppets or lifters, placed round the capstan, were made to rise in succession, as the capstan turned round, by a circular inclined plane placed beneath them, over which their lower extremities moved on friction wheels; and these puppets, as they rose, forced upwards the coils of the messenger on the barrel of the capstan.

This was a superior method to the first, as the operation of forcing upward the coils was performed more gradually by it; but still the wear of the messeuger from the lateral friction in rising against the whelps of the capstan remained undiminished.

The third method used for the same purpose was that proposed by captain Hamilton. It consisted in giving the capstan a conical shape, with an angle so obtuse, that the strain of the messenger forced the coils to ascend along the sloped sides of the barrel. The roller first mentioned was sometimes used with this capstan, of which a full account is inserted in the Repertory of Arts, vol. 2.

The lateral friction, and wear of the messenger against the whelps of the capstan, are equally great in this method as in the others; and it, besides, has the inconvenience of causing the coils to become loose as they ascend; for as the upper part of the barrel is near a third less in diameter than the lower part, the round of the messenger, that tightly embraced the lower part, must exceed the circumference of the upper extremity in the same proportion.

In the method of preventing the necessity of surging, which the model I have had the honour of laying before the Society represents, none of the lateral friction of the messenger or cable against the whelps of the capstan,

(which all the other methods of effecting the same purpose before mentioned labour under,) can possibly take place, and of course the wear of the messenger occasioned thereby will be entirely avoided in it, while it performs its purpose more smoothly, equally, and with a less moving power than any of them.

My method of preventing the necessity of surging consists in the simple addition of a second smaller barrel or capstan of less dimensions to the large one; beside which it is to be placed in a similar manner, and which need not in general exceed the size of a half-barrel cask. The coils of the messenger are to be passed alternately round the large capstan and this small barrel, but with their direction reversed on the different barrels, so that they may cross each other in the interval between the barrels, in order that they may have the more extensive contact with, and better gripe on each barrel. To keep the coils distinct, and prevent their touching each other in passing from one barrel to the other, projecting rings are fastened round each barrel, at a distance from each other equal to about two diameters of the messenger and the thickness of the ring. These rings should be so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other barrel: and this is the only circumstance, which requires any particular attention in the construction of this capstan. The rings should project about as much as the cable or messenger from the barrels, which may be formed with whelps, and in every other respect, not before mentioned, in the usual manner for capstan barrels, only that I would recommend the whelps to be formed without any inclination inwards at the top, but to stand upright all round, so as to form the body of the capstan in the shape of a polygonal prism, if the intervals between the whelps are filled up, in order that the coils

may have equal tension at the top and at the bottom of the barrels, and that the defect which conical barrels cause in this respect may be avoided.

The small barrel should be furnished with falling palls as well as the large one; a fixed iron spindle ascending from the deck will be the best for it, as it will take up less room. The spindle may be secured below the deck, so as to bear any strain, as the small barrel need not be much above half the height of the large barrel; the capstan bars can easily pass over it in heaving round, when it is thought fit to use capstan bars on the same deck with the small barrel. As two turns of the messenger round both barrels will be at least equivalent to three turns round the common capstan, it will hardly ever be necessary to use more than four turns round the two barrels.

The circumstance which prevents the lateral friction of the messenger in my double capstan is, that in it each coil is kept distinct from the rest, and must pass on to the second barrel, before it can gain the next elevation on the first, by which no one coil can have any influence in raising or depressing another; and what each separate coil descends in a single revolution, it regains as much as is necessary in its passage between the barrels, where in the air, and free from all contact with any part of the apparatus, it attains higher elevation without a possibility of friction or wear.

I have described my double capstan, as it is to be used in large vessels, where messengers are necessary, from the great size of the cables; but it is obvious that it is equally applicable in smaller vessels, as their cables can be managed with it in the same manner as is directed for the messenger. The same principle may also be easily applied to windlasses, by having a small horizontal barrel placed parallel to the body of the windlass, and

having both fitted with rings, in the same way as the capstan already described. The proper place for the small horizontal barrel is forward, just before the windlass, and as much below its level as circumstances will admit; it should be furnished with catch-palls as well as the windlass.

Beside the advantages already stated, my proposed improvement to the capstan has others of considerable utility. Its construction is so very simple, that it is no more liable to derangement or injury than the capstan itself. Its cost can be but small, and every part of it can be made by a common ship carpenter, and be repaired by him at sea if damaged by shot. It will take up but little room, only that of a half barrel cask; and it is of a nature so analogous to that kind of machinery, to which sailors are accustomed, that it can be readily understood and managed by them.

In order to render the description of my double capstan more clear, I annex a sketch of it, as fitted up in the manner proposed. I am, &c.

J. WITLEY BOSWELL.

Reference to the Engraving of Mr. Boswell's improved Capstan, to prevent the necessity of surging.

Plate 6, Fig. 1.

A represents the larger or common capstan used on board ships.

B another capstan of less dimensions, placed in a similar manner.

C the coils of the messenger passing alternately round the large and small capstans, but with their direction reversed on the different barrels, so that they may cross each other in the interval between them.

D D D D projecting rings round each capstan or bar-

rel, so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other barrel.

No. 31.

A brief Account of the Manufacture of Gilt Buttons, comprising some Improvements important to Manufacturers. Communicated by Messrs. COLLARD *and* FRAZER, *of Birmingham.**

(With a Plate.)

As the means employed in the manufacture of plain gilt buttons are not universally known, the following summary, while it points out to the manufacturer many considerable advantages, in the use and recovery of his mercury, will also, it is hoped, be found interesting to many readers of the Philosophical Magazine.

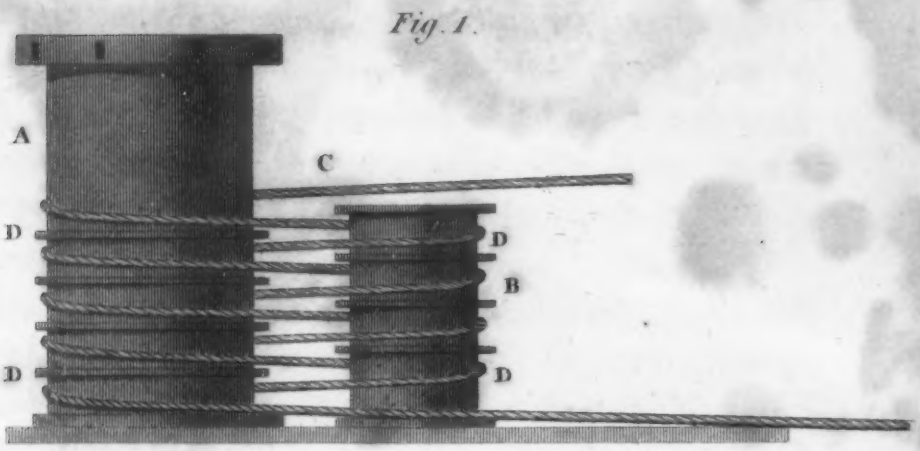
The copper, properly alloyed, is first taken to a rolling mill, and reduced between iron rollers to a proper thickness for the button. The sheets of copper are then brought to the button manufactory, and cut into circular pieces of the size of the intended button by means of a fly-press. In this state they are called *blanks*, and resemble halfpence and farthings worn smooth by long circulation.

The shanks, which are made with wonderful facility and expedition by means of a very curious machine, are then secured to the bottom of each button by a small iron crank, and a small quantity of solder and rosin applied to each. Thus they are placed on a sheet of iron, containing about a gross, and introduced into a very hot

* Tilloch, vol. 9, p. 15.

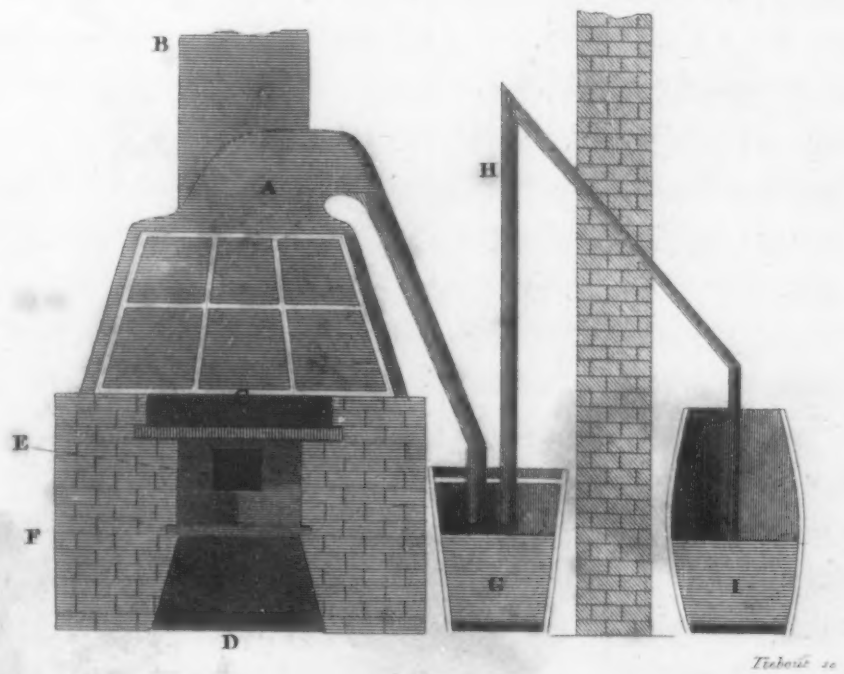
Boswell's Improved Capstan.

Fig. 1.



Manufacture of Gilt Buttons.

Fig. 2.



Emporium of Arts & Sciences Vol. 1. Pl. 6.

stove, where they remain till the workman is satisfied that the solder has melted, and that the shanks are united to the button; after which the edges are smoothed in a lathe.

The next process is what they call *dipping;* that is, a quantity, consisting of a few dozens, is put into an earthen vessel full of small holes like a cullender, and thus dipped into diluted nitric acid to clean them from dirt and rust. They then, according to the best practice, go into the hands of the burnisher, who, in a lathe, burnishes the tops, bottoms, and edges, with a hard black stone, got from Derbyshire, secured in a handle like the diamond of a glazier: this he applies to the button fixed in the end of a piece of wood, turned with great velocity by means of a treddle with which he works the lathe. This is called *rough burnishing*, and is a modern improvement: it is of great advantage, for it closes the pores of the metal opened by the acid, so that the gold afterwards to be applied attaches to a smooth surface, which otherwise might enter into imperceptible cavities, and be closed up in the body of the button by the final burnishing. When the buttons come from the burnisher they are fit for gilding. This is a very curious operation, and truly chemical.

The first process towards gilding is what they call *quicking*, which is effected as follows:—Any given quantity of buttons, perhaps a gross, is put into an earthen vessel with a quantity of mercury which has been previously saturated with nitric acid; and thus the buttons and mercury are stirred together with a brush till the mercury, carried by the affinity of the acid to the copper, adheres to the whole surface of the button. The buttons are then taken out and put into what is called a *basket*, though in fact an earthen vessel full of small holes, the handle of which the operator holds in his

hand, and jerks it with considerable force down towards a wooden trough (a receptacle for the quicksilver) till, by repeated jerks, all the loose particles of mercury are disengaged, leaving a complete continuity over the surface, and giving them the appearance of silver buttons.

Now the gold, a grain of which will spread over many superficial feet of copper, is thus prepared: Any given quantity of mercury is poured into an iron ladle, the inside of which having been previously *guarded*,—that is, rubbed over with dry whiting to prevent the gold from adhering to the iron,—into this mercury is thrown the portion of pure gold intended to cover a given quantity of buttons. The gold and mercury are heated together in the iron ladle till the workman (whose practice soon enables him to judge) perceives that there is a perfect union between them; when he empties his ladle into a vessel containing cold water.

The amalgam being cold, is put into a piece of shammoy leather, and squeezed till no more mercury will pass through. What passes the shammoy contains not the smallest portion of gold; what remains will be about the consistency of butter, so completely united that every particle of mercury shall contain an equal portion of gold. The amalgam should be then put into an earthen vessel, and a small quantity of nitric acid added thereto, allowing sufficient time for the acid to unite with the mercury. But the buttons and amalgam are commonly introduced first, and a quantity of diluted nitric acid added thereto, so that, for want of a complete union between the mercury and acid first, if there be not a superabundancy of acid, there may not be sufficient to carry all the amalgam to the surface of the buttons.

When the acid has had sufficient time to *embrace* (as workmen call it) the mercury, the buttons should be introduced, and be stirred till the amalgam, carried by the

affinity of the acid to the copper, and the tendency which the gold has to extend itself to the mercury with which the buttons have been previously quicked, completely attaches to the whole surface.

It is the next process in which we principally wish to recommend a deviation from the old practice, by which most of the mercury will be recovered, and the gilder's health, in a great measure, preserved from the dreadful effects of volatilised mercury.

The old practice is as follows: The buttons being completely covered with mercury and gold, the operator proceeds to that business which is called *drying-off*, which is performed thus: The buttons, to the quantity of a few dozens, are put into an iron pan somewhat like a large frying-pan, placed over a fire, and gently shook, while the operator watches carefully till he observes the mercury begin to flow;—upon the first symptom of which, he takes the pan from the fire, and throws the buttons into a large cap, called a *gilding cap*, like a man's hat with a very small brim, but much larger in the crown, made of coarse wool and goats hair. In this cap, with a circular brush, the buttons are stirred, to spread the gold and mercury while in a degree of temperature nearly sufficient to volatilise the mercury. The buttons are again thrown into the pan, placed over the fire, and shaken, while the mercury gently volatilises. The buttons are again thrown into the cap, and stirred with the brush. This process is continually repeated, till all the mercury is volatilised, leaving the gold on the buttons, which appear again of a yellow colour.

Thus a principal part of the mercury ascends the chimneys, is deposited on the tops of the houses and about the adjacent neighbourhood, and great quantities are inhaled and absorbed by the operator, keeping him

nearly in a state of salivation till disease obliges him to desist.

Considerable quantities of mercury thus volatilised are found united and collected in small pools in the spouts and gutters on the tops of the buildings. Thus many tons of mercury have been dissipated about the town and neighbourhood of Birmingham, to the great injury of the inhabitants. The poor sweep who has ascended the chimneys has been salivated, and the manufacturer has sustained considerable loss.

To preserve a principal part of the mercury thus dissipated, and to prevent, in a great measure, the terrible effects of it on the constitution of the operator, is the object of these remarks, as far as it regards manufacturers.

By means of an apparatus similar to the plan delineated in Plate 6, fig. 2, which has been partially and successfully adopted by Mr. Mark Sanders, an eminent button-maker of Birmingham, the principal part of the mercury may be recovered, and the health of the operator greatly preserved.

A hearth of the usual height is to be erected, in the middle of which a capacity for the fire is to be made; but instead of permitting the smoke to ascend into the top A, made of sheet or cast iron, through which the mercury is volatilised, a flue for that purpose should be conducted backwards to the chimney B. An iron plate, thick enough to contain heat sufficient to volatilise the mercury, is to cover the fire-place at the top of the hearth C. There must be an ash-hole, D, under the fire-place. The square space E, seen in the fire-place, is the flue, which serves to carry the smoke back under the hearth into the chimney B. The door of the fire-place and ash-pit may either be in front, as represented in the plate, or at the end of the hearth at F, which will perhaps less incommode the work-people. It would be of great advantage

if the space between A and the iron plate C was covered up with a glass window coming down so low as only to leave sufficient room for moving the pan backwards and forwards with facility. If the sides were also glass instead of brick-work it would be still better, as the work-people would be able to have a full view of their work without being exposed to the fumes of the mercury, which, when volatilised by heat communicated to the pan by the heated iron plate over the fire-place, would ascend into the top A, appropriated for its reception, and descend into the tub G, covered at top and filled pretty high with water. By this means the hearth would, in fact, become a distilling apparatus for condensing and recovering the volatilised mercury. In the tub G the principal part would be recovered; for, of what may still pass on, a part would be condensed in ascending the tube H, and fall back, while the remainder would be effectually caught in the tub or cask I, open at the top and partly filled with water. The latter tub should be on the outside of the building, and the descending branch of the tube H should go down into it at least 18 inches, but not into the water. The chimney or the ash-pit should be furnished with a damper to regulate the heat of the rfie.

The water may be occasionally drawn out of the tubs by a siphon, and the mercury clogged with heterogeneous matter may be triturated in a piece of flannel till it passes through, or placed in a pan of sheet iron, like a dripping-pan, in a sufficient degree of heat, giving it a tolerable inclination, so that the mercury, as it gets warm, may run down and unite in the lower part of the pan. But the mercury will be most effectually recovered by exposing the residuum left in the flannel bag to distillation in a retort made of iron or of earthenware.

When the mercury is volatilised from the buttons, or,

as the workmen denominate it, when the buttons are dried off, they are finally burnished, and are then finished and fit for carding.

The reader unacquainted with this branch of manufacture will be surprised to learn how far a small quantity of gold, incorporated with mercury, will spread over a smooth surface of copper. Five grains, worth one shilling and threepence, on the top of a gross, that is, 144 buttons, each of one inch diameter, are sufficient to excuse the manufacturer from the penalty inflicted by an act of parliament; yet many, upon an assay, are found to be deficient of this small quantity, and the maker fined and the buttons forfeited accordingly. Many hundred grosses have been tolerably gilt with half that quantity; so extremely far can gold be spread, when incorporated with mercury, over the surface of a smooth piece of copper.

No. 32.

List of American Patents.

(Continued from page 157.)

1795.

Jacob Perkins, Jan. 16, machine for cutting nails.

Samuel Mulliken, Jan. 15, improvement in the mode of breaking flax and hemp.

Samuel Kellogg, Jan. 31, improvement in shearing woollen and other cloths.

Josiah G. Peerson, March 23, machine for cutting nails.

Joseph Ellicott, March 25, new mode of catching fish.

S. Morey, March 25, improvement in the application of steam.

John Youle, May 25, construction of a caboose.

J. Pitman, May 25, improvement in the manufacturing of cordage.

Daniel Keller, May 25, improvement in propelling boats.

W. P. Sprague, June 19, propelling boats, &c. with horses.

Benjamin Wynkoop, June 19, nautical ventilators.

John Taylor, June 30, tinned sheet copper condensing worm.

1796.

Jared Byington, Jan. 15, improvement in making nails.

Jonathan Dickerson, Jan. 9, improvement in sawing and polishing marble, &c.

James Eaton, Feb. 12, manufacturing seal skins.

E. Perkins, Feb. 19, removing pains, &c. by metallic points.

Samuel Morey, April 11, raising water by wind.

Benjamin Tyler, April 15, machine for cleaning wheat, &c. &c.

James Davis, April 14, improvement in tanning leather.

T. Bidwell, April 20, improved mode of forming a yellow colour

Samuel Lee, jun. April 30, composition of " bilious pills."

Peter Zacharie, May 4, machine for cutting nails and brads.

J. Hilyard, May 12, improvement in manufacturing sumach.

Robert Dawson, May 12, improvement in bolting cloths.

Hodgen Holmes, May 12, improvement in the cotton gin.

J. Roberts, jun. Feb. 13, cleaning clover and other seeds, &c.

James Sylvanus M'Lean, May 27, improvement in piano fortes.

Oliver Evans, May 28, improvement in burr mill-stones.

Elijah Backus, May 31, new invented steam engine and boiler.

L. M'Kechnie, July 1, stays for removing distortions in the spine.

Joseph Francis Mangin, July 2, improvement in sawing and polishing marble, &c.

Robert Grant, Oct. 17, machine for scouring rice and other grain.

George James, Nov. 16, improvement in making salt.

John Fowler, Nov. 16, improvement in concentrating the volatile parts of calcareous earth, stones, &c.

Peter Cliff, Nov. 16, improvement in manufacturing cut nails.

Isaac Garretson, Nov. 16, machine for heading and cutting nails.

Apollos Kinsley, Nov. 16, improvement in a printing press.

James Stanfield, Nov. 16, improvement in splitting sheep skins.

Mark I. Brunel, Nov. 16, new method of ruling books and paper.

Theobald Bourke, Nov. 16, improvement in pumps.

William Frobisher, Nov 17, manufacturing potash.

Clement Rentgen, Nov. 17, improvement in forging bolts and round iron.

Amos Whittemore, Nov. 17, improvement in a loom for weaving cloth.

Amos Whittemore, Nov. 19, a " preambulator" for measuring a ship's way.

Amos Whittemore, Nov. 19, machine for cutting nails.

John Bigelow, Nov. 19, improvement in manufacturing nails.

George Chandlee, Dec. 12, improvement in cutting and heading nails, &c.

Thomas Passmore, Dec. 23, conjuror for cooking and boiling.

D. French, Dec. 23, improvement in manufacturing cut nails.

D. French, Dec. 23, improvement in manufacturing wrought nails.

Jared Byington, Dec. 23, improvement in heading nails.

Jason Frost, Dec. 23, improvement in heading nails.

James Dellet, Dec. 23, machine for separating scoured rice.

Robert Watkins, Dec. 23, improvement in ginning cotton.

John Murray, Dec. 23, improvement in ginning cotton.

1797.

John Nazro, Jan. 6 improvement in making soap.

John Nazro, Jan 6, extracting alkali from marine salt and kelp.

Charles Wilson Peale, Jan. 21, improvement in bridges.

J. Spence, Feb. 16, improvement in cutting and heading nails.

Joseph F. Mangin, Feb. 16, improvement in cutting and polishing marble, &c.

James M'Callmont, Feb. 20, improvement in stoves.

S. Mulliken, Feb. 20, improvement in scouring or skinning rice.

Richard Stuart, Feb. 24, improvement in chimneys.

John Fowler, Feb. 24, improvement in bridges.

Jesse Kersey, Feb. 24, improvement in cutting and heading nails.

L. Allwine, Feb. 24, improvement in mixing colours and painting.

Thomas Hirst, March 11, improvement in stoves.

William Booker, March 11, machine for threshing wheat, &c.

Silas Betts, March 18, improvement in a tide water wheel.

Nathaniel Briggs, March 18, improvement in washing clothes.

Caleb Wheaton, March 29, improvement in stoves.

Jesse Kersey, April 13, improvement in fire engines.

Caleb Leach, April 13, improvement in boring pumps.

Fitch Hall, April 17, combination of astringent woods and vegetables in distilling, &c.

Jehoshaphat Starr, April 28, improvement in propelling boats and vessels, by steam engines

William Faris, April 29, improvement in propelling carriages.

Benjamin Duval, May 3, antibilious pills.

Isaac Garretson, May 29, improvement in constructing and rigging vessels.

Amos Whittemore, June 5, improvement in manufacturing wool cards, &c.

David Grieve, June 8, improvement in looms.

Walter Burt, June 23, raising a nap on cloths.

Benjamin Seymour, June 26, rollers for slitting and other mills for rolling iron.

B. Seymour, June 26, improvement in straightening iron hoops.

B. Wynkoop, June 26, pendulous bellows, for pumping ships.
Joseph S. Sampson, June 26, improvement in making candles.
Charles Newbold, June 26, improvement in ploughs.
Moses Johnson, June 30, mode of preserving butter.
J. Hawkins, July 11, improvement in forming bricks, tiles, &c.
Thomas Bruff, July 1, improvement in extracting teeth.
Bill Jarvis, July 8, improvement in making shingles, boards, &c.
Apollos Kinsley, August 12, improvement in cutting tobacco.
J. Nevil, Aug. 12, improvement in cutting and heading nails.
Henry Dulheur, August 18, improvement in saw-mills.
Jonathan W. Curtis, August 24, improvement in mills.
Charles W. Peale, Nov. 16, improvement in fire-places.
Thomas Stickney, Nov. 16, improvement in saddles.
Daniel Pettibone, Nov. 16, improvement in breaking dough and paste.
Richard R Eliot, Nov. 16, improvement in threshing grain.
Eli Terry, Nov. 17, improvement in clocks, time-keepers, and watches.
Stephen Parsons, Nov. 20, improvement in making sashes.
John Martin, Nov. 21, machine for propelling boats.
Timothy Palmer, Dec. 17, improvement in bridges.
Elias Ring, Dec. 10, a spiral wheel for working in tide-water.
William Payne, Dec. 10, a soap-stone stove.
Lester Fling, Dec. 19, improvement in making nails.

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*List of English Patents.**

1796.

William Desmond, Jan. 15; for a method or process of tanning all sorts of hides and skins, and of rendering more solid and incorruptible, in water, several vegetable and animal substances, such as flax, hemp, spartery, cotton, silk, hair, wool, &c. as well as the materials made thereof.

Isaac Wheildon, and John Bowler, April 26; for a new method of making and working presses for packing goods.

William Goldfinch, May 24; for the invention of an improved truss for the cure and prevention of ruptures.

Joseph Stacey Sampson, May 24; for the invention of an art or method of cutting up tallow-fat, spermaceti, and wax, for melting; and of making the same into candles.

John Strong, May 31; for the invention of certain new improve-

* Repertory, vol. 7.

ments in the construction of piston-cylinders, suction-chambers, and valves, whereby the same may be more expeditiously repaired.

John Howell, May 31; for an improved engine or machine for the purpose of boring or hollowing wooden water-pipes, or aqueducts, in a much more expeditious manner than hitherto practised, and whereby a considerable saving will be made in timber.

William Booth, May 31; for the invention of an improvement in making stays and corsets.

William Law, May 31; for certain new improvements in and upon water-closets.

Edward Haskew, May 31; for an engine for raising earth from the bottom of canals, or any other place of depth, to the surface of the earth.

John Pepper, June 9; for the invention of a certain kiln, for drying malt or other grain.

James Keeling, June 20; for a substitute for white-lead, red-lead, or any other preparation of lead, in glazing and enamelling all manner of earthen and China wares, &c.

William Whittington, June 28; for a portable baking-stove.

William Bundy, June 28; for a machine for cutting and making combs.

James Parker, June 28; for a cement or terras, to be used in aquatic and other buildings, and stucco work.

John Ching, June 28; for a medicine for destroying worms.

Robert Miller, June 28; for a method of weaving all kinds of linen, cotton, woollen, and worsted cloths, by looms wrought by water, steam-engines, horses, or any other power.

William Batley, June 28; for an improvement in the working of steam-engines.

Daniel Davis, July 4; for an apparatus or machinery for cleansing or sweeping of chimneys, and extinguishing them when on fire, without sending any person up the chimney.

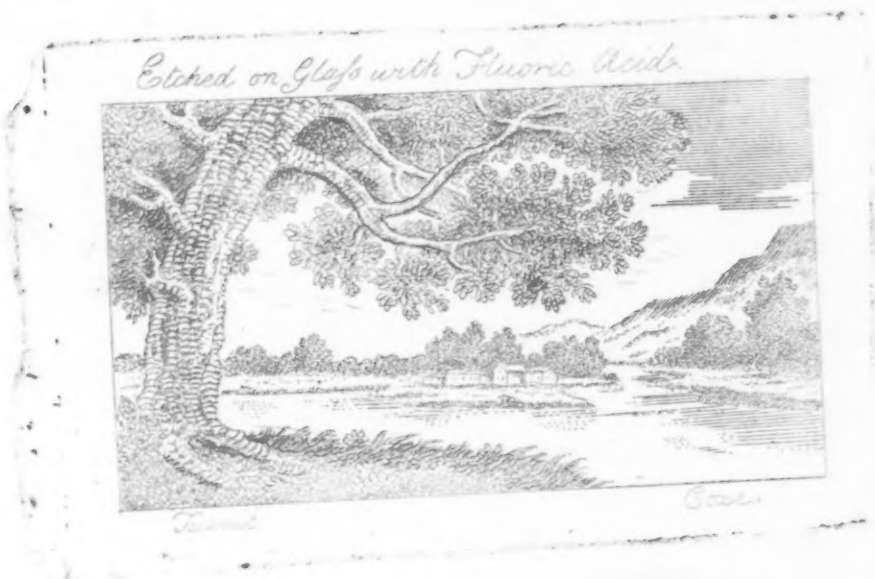
William Sabatier, July 4; for a method of retaining cotton, hemp, flax, hops, hay, and other articles, in nearly the same compass in which they can be compressed.

INTELLIGENCE.

Etching on Glass with Fluoric Acid.

The Editor has great pleasure in presenting to the public a small landscape from an etching on glass with fluoric acid, one of the constituents of the ornamental Derbyshire spar. This engrav-

ing is not to be viewed with the eye of fastidious criticism; although in itself it is by no means an indifferent performance, yet its merit arises from its singularity. Probably



ing of musket ball, at an elevation of 45 degrees, when the enemy have made their approaches to within a certain distance, which may be effected without their being exposed, and the shot will do more execution, not being stopped by the enemy's works. Mr. Carnot's suggestion has been adopted in France, and now forms part of the artillery exercise. *Tilloch, No.* 159.

ments in the construction of piston-cylinders, suction-chambers, and valves, whereby the same may be more expeditiously repaired.

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ing is not to be viewed with the eye of fastidious criticism; although in itself it is by no means an indifferent performance, yet its merit arises from its singularity. Probably, not one hundred persons in the United States have ever had an opportunity of seeing a similar production. The great difficulty of passing the glass through the press of the copper-plate printer, without breaking it, which, in common with others, the Editor has experienced, has always prevented this species of engraving from being extended beyond the etching itself. The only plate which is known to the Editor as successfully accomplished, is a frontispiece to the 3d London edition of Parke's Chemical Catechism. It is scarcely more than a bare outline of some of the apparatus of chemical scienee; and, although so rudely executed, as to bear no comparison with the present, yet Mr. Parke says of it, "I have reason to believe it exhibits a more favourable specimen of printing from glass, etched by fluoric acid, than any that has hitherto been produced." (p. 233.)

The Editor is much indebted to the assistance of Mr. Tiebout whose excellence as an engraver is well known; but he is more especially so to the patience and perseverance of Mr. Duffy, (copper-plate printer, with Mr. Dainty, of this city,) by whose co-operation the plate has been so successfully printed. The difficulty may be appreciated, when it is stated, that after seven hundred plates had been taken off, the glass was unfortunately broken, and the design of giving it to the public was nearly suspended. The uncommon patronage however which the Emporium has already received, called for every exertion on the part of the Editor; and he accordingly executed another etching from the former, from which the remaining plates have been taken; and in a way, which experience leads him to hope, will facilitate any future attempts of this nature.

Intelligence and Miscellaneous Articles: including Memoranda, Hints, Precepts, and Recipes, for the use of Artists, Manufacturers, and others.

Mr. Carnot in his new treatise on the defence of fortified places, recommends the besieged to fire howitzers wadded with grape shot or musket ball, at an elevation of 45 degrees, when the enemy have made their approaches to within a certain distance, which may be effected without their being exposed, and the shot will do more execution, not being stopped by the enemy's works. Mr. Carnot's suggestion has been adopted in France, and now forms part of the artillery exercise. *Tilloch, No.* 159.

Mr. Henz, an eminent tanner at Srzensk, in Poland, has ascertained that the leaves of the oak may be advantageously substituted for the bark, in tanning leather, provided they are used in the month of September, when they possess the bitter sap which they afterwards lose. *Tilloch, No.* 159.

To make a common watch into a nocturnal one, Mr. E. Walker of London, " made notches with a file in the rim of its inner case, against every hour upon the dial, except 3, 6, 9, and 12. These tangible marks are made no deeper than just to receive the nail of the finger or thumb, as it is drawn over them. The hour of 12 is known by the pendant, and little pins are fixed into the case at the hours of 3, 6, and 9, projecting outwards about one-twetieth of an inch, to distinguish those hours from the rest.

To ascertain the time in the dark by this watch, open the glass, and feel with the finger the situation of the hour hand, and correct the tangible marks, beginning at 3, 6, 9, or 12, to find the hour; and by the same means the minutes are found.

Mr. W. considers it as giving the time with more precision than a repeater, and without disturbing the repose of any person near it. *Tilloch, No.* 167.

PREPARATION OF BRUNSWICK GREEX.

Kasteleyn has lately published the following method of preparing this colour, which is much used on the Continent for oil painting, and in the manufacturing of printed paper. Shavings of copper are put into a close vessel, and besprinkled with a solution of the muriat of ammonia. The metal first unites with the muriatic acid, and is dissolved, and is in its turn precipitated by the disengaged ammonia, to which it now joins itself. The precipitate is then washed and dried in wooden boxes, or upon an extended cloth. The liquid which remains, as well as the water of the first washing, may be employed several times in succession for new operations, by dissolving in it fresh portions of sal ammoniac to the point of saturation. Three parts of the muriat of ammonia are sufficient for two parts of copper, and the result is six parts of colour. This beautiful green is in Holland called Friesland green. It is almost always adulterated with ceruse. *Tilloch, vol.* 4.

CEMENT FOR FILLING UP CRACKS AND FISSURES IN IRON VESSELS.

The same author has also made known this cement. It consists of six parts of yellow potter's clay, one part of the filings of iron, and a quantity of linseed oil sufficient to form the whole into a paste of the consistence of putty. *Tilloch, vol.* 4.